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Re-evaluation Note REV2016-06

Chlorothalonil

Amendment to the Proposed Re-evaluation Decision

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Publications
Pest Management Regulatory Agency
Health Canada
2720 Riverside Drive
A.L. 6607 D
Ottawa, Ontario K1A 0K9

Internet: pmra.publications@hc-sc.gc.ca
healthcanada.gc.ca/pmra
Facsimile: 613-736-3758
Information Service:
1-800-267-6315 or 613-736-3799
pmra.infoserv@hc-sc.gc.ca

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Amended Proposed Re-evaluation Decision

The purpose of this document is to notify registrants, pesticide regulatory officials and the Canadian public that Health Canada's Pest Management Regulatory Agency (PMRA) has amended its Proposed Re-evaluation Decision for chlorothalonil, PRVD2011-14.

Following the publication of PRVD2011-14, *Chlorothalonil*, the PMRA has revised the occupational and residential risk assessments with more information relevant to the potential effects of chlorothalonil on human health, particularly via dermal exposure. All other components of the proposed re-evaluation decision for chlorothalonil remain as originally described in PRVD2011-14.

Based on the revised occupational and residential risk assessments for chlorothalonil, the PMRA has determined that under the revised conditions of use, some agricultural uses of chlorothalonil do not present unacceptable risks to human health. These uses include asparagus, carrot, celery (seedbeds only), cucurbits, ginseng, mushroom, parsnip, potato, strawberry, tomato, turf (for control of snow mould only). As a condition of continued registration of these uses, new risk-reduction measures are proposed to be included on the labels of pest control products containing chlorothalonil.

Based on the human health risk assessment, the PMRA is proposing to cancel the following uses of chlorothalonil:

- Agricultural uses: blueberry, highbush; blueberry, lowbush; celery, field; cherry (sweet and sour); chickpea; Cole crops; conifers (outdoor and nursery beds); corn, sweet; cranberry; evening primrose; lentil; nectarine; onion (dry and green); ornamentals (greenhouse and outdoor); pea, dry; peach; wheat; and turf (except for control of snow mould);
- Material preservative use: paint.

Next Steps

This amended proposed re-evaluation decision is a consultation document.[1] The PMRA is inviting stakeholders to submit comments on this document, as well as detailed proposals to further refine the risk assessment and mitigate risks. The PMRA will accept comments and proposals for a period of 60 days from the date of publication of this document. Please forward all comments to Publications.

Before making a final re-evaluation decision on chlorothalonil, the PMRA will consider all comments received in response to the previously published Proposed Re-evaluation Decision, along with any comments or proposals submitted in response to this amended proposed re-evaluation decision. A science-based approach will be applied in making a final decision on chlorothalonil. The PMRA will then publish the Re-evaluation Decision that will include the

[1] "Consultation statement" as required by subsection 28(2) of the *Pest Control Products Act*.

decision and the reasons for it, a summary of the comments and proposals received on both this document and PRVD2011-14, and the PMRA's response to these comments and/or proposals.

If no proposals to refine the risk assessment are received, or if those received are inadequate, then the PMRA will proceed to finalize the re-evaluation decision to cancel the chlorothalonil uses specified in this document.

1.0 Registered Chlorothalonil Uses

Chlorothalonil, a broad-spectrum non-systemic fungicide, is registered in Canada to control fungal foliar diseases on terrestrial and greenhouse food crops, greenhouse and outdoor ornamentals, conifers, and turf. It is also registered for use as a material preservative in paint. Currently registered pest control products containing chlorothalonil are listed in Appendix I.

A detailed chlorothalonil use pattern is summarized in Appendix II (Tables 1–4).

2.0 Human Health

2.1 Toxicological Profile of Chlorothalonil

Technical chlorothalonil was of low acute toxicity to rats and rabbits after oral or dermal exposure and was highly acutely toxic via the inhalation route. It was severely irritating to rabbit eyes and minimally irritating to the rabbit skin. Chlorothalonil was not a dermal contact sensitizer.

The kidney and stomach were identified as the target organs in rats and mice in short-term and chronic studies. Short-term exposure resulted in pre-neoplastic lesions leading to neoplastic lesions in chronic exposure. The genotoxic potential of chlorothalonil was negative in vivo with some evidence of weak genotoxicity in vitro.

No teratogenic effects were observed in either rats or rabbits exposed to chlorothalonil via oral gavage. In a two-generation reproduction study, lower mean pup body weight was reported in pups at weaning (day 21) in the presence of maternal toxicity. Treatment-related histopathological lesions in the kidneys and forestomach were evident in parental animals at all dose levels tested. No reproductive effects were reported following exposure to chlorothalonil. No signs of neurotoxicity were reported in a subchronic neurotoxicity study.

For assessing risks from potential residues in food or from products used in or around homes or schools, the *Pest Control Products Act* requires the application of an additional 10-fold factor to threshold effects to take into account completeness of the data with respect to the exposure of, and toxicity to, infants and children, and potential prenatal and postnatal toxicity. A different factor may be determined to be appropriate on the basis of reliable scientific data. With respect to the completeness of the toxicity database as it pertains to the toxicity to infants and children, the database contains the standard complement of required studies including developmental toxicity studies in rats and rabbits and a two-generation reproductive toxicity study in rats. No

evidence of developmental effects or sensitivity of the young was observed in the rat or the rabbit. In the rat two-generation reproductive toxicity study, the effect on young (lower mean pup body weight) was observed at the highest dose tested while treatment-related effects occurred at all doses tested in parental animals. Overall, the database is adequate for determining the sensitivity of the young and effects on the young. The default 10-fold *Pest Control Products Act* factor can be reduced to 1-fold.

2.1.1 Toxicological Endpoints for Human Health Risk Assessment

The PMRA determined that the No Observed Adverse Effect Level (NOAEL) of 600 mg/kg bw/day from a 21-day dermal toxicity study in rats, previously considered for the short-/intermediate-term occupational dermal risk assessment (PRVD2011-14), was not appropriate for the assessment of short/intermediate term occupational dermal risks considering that the study duration is shorter than the expected duration of occupational exposure. In the absence of a longer-term dermal toxicity study, the NOAEL of 1.5 mg/kg bw/day from both the 90-day oral toxicity study in rats and the 2-year oral toxicity study in rats was selected by the PMRA for occupational dermal assessments of all durations. This endpoint was also used for assessing of inhalation and incidental oral risks, and, aggregate risk to golfers.

The NOAEL of 600 mg/kg bw/day from a 21-day dermal toxicity study in rats was considered, however, appropriate for the assessment of acute dermal risks for the pick-your-own (PYO) scenario.

To ensure that there is a protective margin between the dose levels that elicit toxicity in laboratory animal studies and the anticipated human exposure, uncertainty factors were applied to the most relevant endpoints in the mammalian toxicity database. For chlorothalonil risk assessments, a 10-fold uncertainty factor for inter-species extrapolation and 10-fold uncertainty factor for intra-species variability were applied. The *Pest Control Product Act* factor was reduced from 10 to 1 since there was no evidence of developmental effects or sensitivity of the young. Consequently, a target Margin of Exposure (MOE) of 100 was established for dermal and inhalation exposure scenarios. For the acute dietary exposure scenario (including pick-your-own scenario), an additional 3-fold uncertainty factor was applied to account for Lowest Observed Adverse Effect Level (LOAEL) to NOAEL extrapolation, resulting in a target MOE of 300.

Based on the weight-of-evidence, the PMRA concluded that the mode of action for the renal carcinogenesis of chlorothalonil has not been adequately delineated. Therefore, consistent with PRVD2011-14, a quantitative cancer risk for chlorothalonil was conducted using a linear extrapolation.

Based on dermal absorption studies submitted to the PMRA, a dermal absorption factor of 19% of the oral dose was established for chlorothalonil. Inhalation absorption was considered to be 100% of the oral dose.

Toxicological endpoints selected by the PMRA for human health risk assessment are summarized in Appendix III.

Since impurities, hexachlorobenzene (HCB), dioxin-like chemicals and decachlorobiphenyl, are present in the technical grade chlorothalonil that was used in mammalian toxicology studies, the potential toxic effects of these impurities are taken into account when characterizing the hazards of the technical ingredient and setting toxicological endpoints of concern for human health risk assessments.

TSMP Track 1 Contaminants of Health or Environmental Concern found in technical grade active ingredients are managed in accordance with Health Canada's strategy to prevent or minimize releases into the environment, with the ultimate goal of virtual elimination. Health Canada's strategy is described under Regulatory Directive DIR99-03, *The Pest Management Regulatory Agency's Strategy for Implementing the Toxic Substances Management Policy*.

2.2 Occupational Exposure and Risk Assessment

Workers can be exposed to chlorothalonil through mixing, loading and/or applying the pesticide in agricultural or industrial settings, while re-entering treated sites (for example fields and greenhouses) to conduct postapplication activities such as scouting and handling of treated crops or while applying paint treated with chlorothalonil.

2.2.1 Mixer/Loader/Applicator

The PMRA calculated combined (dermal and inhalation) exposure estimates for workers mixing/loading and applying chlorothalonil in agricultural settings using exposure data from the Pesticide Handlers Exposure Database (PHED) or the Outdoor Residential Exposure Task Force (ORETF). Exposure estimates for workers in industrial settings were derived from the Chemical Manufacturers Association (CMA) Antimicrobial Exposure Study. Additional assumptions included a maximum registered application rate for each use, 19% dermal and 100% inhalation absorption, default or use-specific values for area treated per day (ATPD) or volume handled per day, and the average worker body weight of 80 kg. Lifetime average daily dose (LADD values were calculated by amortizing exposure over the lifetime assuming workers would work for 40 years with a life expectancy of 78 years.

Based on the currently registered use pattern for chlorothalonil, the PMRA assessed the following exposure scenarios:

- Mixing/loading of liquid or dry flowable formulation and applying as a liquid spray using groundboom equipment;
- Mixing/loading of liquid or dry flowable formulation and applying as a liquid spray using airblast equipment;
- Mixing/loading of liquid or dry flowable formulation for aerial application and chemigation applications;

- Mixing/loading of liquid or dry flowable formulation and applying as a liquid spray using handheld equipment in greenhouses and outdoor nurseries;
- Mixing/loading of liquid or dry flowable formulation and applying as a liquid spray using handheld equipment to turf (spot treatment);
- Mixing/loading of liquid or dry flowable formulation into paint in industrial settings;

The risk assessments with measures required to mitigate the risks to mixers/loaders/applicators are summarized in Appendix IV, Table 1–6.

For agricultural workers mixing, loading and applying chlorothalonil, non-cancer and cancer risks are not of concern for all crops provided that additional mitigation measures such as a limit on the maximum allowed amount of active handled per day, additional personal protective equipment (PPE) and/or engineering controls are implemented.

For industrial workers, non-cancer and cancer risks are not of concern for workers handling a liquid formulation when assuming PPE consisting of a single layer of clothing and gloves. For workers handling a solid formulation, non-cancer and cancer risk are not of concern provided that workers wear PPE consisting of a single layer of clothing and gloves and use a closed mixing/loading system (water soluble packaging).

Mitigation measures proposed to reduce the potential risks for workers mixing/loading and applying commercial-class products containing chlorothalonil are included in Section 3.0.

2.2.2 Postapplication workers

2.2.2.1 Agricultural workers

Agricultural workers can be exposed to chlorothalonil residues when re-entering treated sites to conduct postapplication activities such as scouting and harvesting. Exposure of agricultural postapplication workers is expected to be of a short-/intermediate- (field crops) or a long-term (greenhouse uses) duration and to occur primarily via the dermal route. Considering low volatility of chlorothalonil relative to the NAFTA criterion for a waiver of inhalation exposure data for both outdoor and indoor uses (NAFTA, 1999) and assuming at least 12 hours have passed before re-entry, inhalation exposure to chlorothalonil is not expected to be of concern for workers re-entering treated sites.

To protect workers involved in postapplication activities, restricted-entry intervals (REIs) are calculated to determine the minimum length of time required before people can enter the field to conduct hand labour following pesticide application. An REI is the duration of time that must elapse before residues decline to a level where performance of a specific activity results in exposures below the level of concern (in other words, calculated MOEs are above target MOEs for all durations of exposure and cancer risk is below 1×10^{-5}).

The PMRA calculated daily dermal exposure estimates for postapplication agricultural workers using default dislodgeable foliar residue (DFR) or transferable turf residue (TTR) values. Additional inputs included transfer coefficient (TC) values from studies conducted by the Agricultural Re-Entry Task Force (ARTF), an 8-hour work day (unless specific use information was available), 19% dermal absorption, and an average worker body weight of 80 kg. If a crop-specific TC value was not available, TC values for crops with similar morphology or agricultural practice were extrapolated for risk assessment. For workers entering treated mushroom-houses, exposure estimates were calculated using the approach described in PRVD2011-14. For cancer assessment, time-weighted average (TWA) DFRs and TTRs were calculated over 30 days for all crops except for greenhouse crops for which peak DFRs were assumed for risk assessment. LADD values were calculated by amortizing exposure over the lifetime assuming workers would work for 40 years with a life expectancy of 78 years.

The risk assessment with measures required to mitigate the risks to postapplication workers is summarized in Appendix V, Table 1.

For agricultural scenarios considered for this re-evaluation, potential risks of concern were identified for postapplication workers performing activities, such as thinning, pruning and scouting of crops under current conditions of use. The PMRA determined that:

- Under the current use pattern which allows multiple applications of chlorothalonil, the calculated REIs required to mitigate the risks to postapplication workers may only be feasible for asparagus, strawberry, carrot, and parsnip.

- With a reduced number of chlorothalonil applications, the calculated REIs required to mitigate potential risks to postapplication workers may be feasible for mushrooms, celery seedbeds (greenhouse), cucurbits, ginseng, potato, and tomato. For the remaining uses, the calculated REIs required to mitigate potential risks to postapplication workers may not be agronomically feasible.

- The calculated REIs may not be feasible for workers re-entering treated sod farms and golf courses to conduct postapplication activities including transplanting/planting, mowing, and scouting. However, taking into consideration that for control of snow mould, chlorothalonil is applied on turf in late fall, just before snow fall, it is unlikely that workers will re-enter treated fields to conduct typical maintenance activities. Therefore, the potential for postapplication exposure of concern to chlorothalonil residues following an application for control of snow mould is considered to be low. On this basis, a single late fall application of chlorothalonil to turf (golf course and sod farm) for control of snow mould is considered acceptable.

Mitigation measures proposed to reduce the potential risks for postapplication workers are included in Section 3.0.

2.2.2.2 Professional painters (secondary handlers)

There is a potential for exposure of professional painters applying paint treated with chlorothalonil. Exposure of workers applying treated paint is expected to be of a short- to long-term duration and to occur by both dermal and inhalation routes. The PMRA estimated dermal and inhalation daily exposures for professional painters using PHED exposure data for individuals wearing a single layer of clothing and no gloves. Application rates and volumes of products handled per day were derived from the product labels and previous PMRA assessments for similar antimicrobial active ingredients.

The exposure and risk assessment for professional painters is summarized in Appendix V, Table 2. Potential non-cancer and cancer risks of concern were identified for professional painters using a paintbrush and an airless sprayer. The PMRA did not identify feasible mitigation measures to address these potential risks.

2.3 Non-occupational Exposure and Risk Assessment

There are no domestic-class products containing chlorothalonil registered in Canada. Commercial-class products containing chlorothalonil are not registered for use on turf and ornamentals in residential settings. Residential exposure to treated ornamentals obtained from commercial nurseries or greenhouses was not assessed as these uses are proposed for cancellation based on the results of the occupational exposure risk assessment (see Section 3.0). There is, however, a potential for exposure of the general public to chlorothalonil residues while applying treated paint, harvesting treated fruits in orchards open to the public (PYO facilities), or playing golf on treated turf. Further, there is a potential for inhalation exposure of bystanders to chlorothalonil in agricultural areas due to spray drift.

Non-occupational exposure risk assessments are summarized in Appendix VI, Table 1–4.

For a homeowner applying treated paint, the PMRA assessed short-term combined (dermal and inhalation) exposure using PHED data. Potential non-cancer and cancer risks of concern were identified for individuals applying paint containing chlorothalonil.

For adults and children harvesting fruits at PYO facilities, the PMRA assessed acute dermal exposure for adults and children using default DFR values for strawberry, blueberry, peach, and nectarine. Acute dietary exposure resulting from fruit consumption at the PYO facility was assessed using the Dietary Exposure Evaluation Model software with the Food Commodity Intake Database (DEEM-FCID, version 2.16), which incorporates food consumption data from the USDA (United States Department of Agriculture) Continuing Surveys of Food Intakes by Individuals (CSFII) 1994-1995 and 1998. The resulting acute dermal and acute dietary exposure estimates were aggregated to determine the total exposure from a single day event of harvesting at the PYO facility. Since uncertainty factors for dermal and dietary routes differ, the PMRA calculated the Aggregate Risk Index (ARI) for the assessed commodities. The estimated ARIs are above 100 (target ARI of 1) and indicate no risks of concern.

For golfers entering treated golf courses following a late fall application of chlorothalonil for control of snow mould, non-cancer and cancer risks are not expected to be of concern taking into consideration that golfers would not enter treated fields until the following spring. Potential risks of concern were identified for the remaining chlorothalonil uses on turf.

For bystanders, the PMRA assessed short-term inhalation risk using the maximum concentrations of chlorothalonil in the air reported in the open literature. Non-cancer and cancer risks for bystanders in agriculture areas are not of concern.

2.4 Aggregate Exposure and Risk Assessment

Aggregate risk combines the different routes of exposure to chlorothalonil. For homeowners applying treated paint, an aggregate risk assessment was not conducted since the residential paint scenario resulted in potential risks of concern (see Section 3.0 for proposed risk mitigation).

For golfers, the likelihood of aggregate exposure to chlorothalonil is considered to be low based on the timing of application for control of snow mould. Consequently, the aggregate risk assessment for golfers was not required.

For bystanders, inhalation exposure is not expected to contribute significantly to the aggregate risk based on results of the bystander inhalation risk assessment. Consequently, the aggregate risk for bystanders was not expected to be of concern.

3.0 Mitigation Measures Proposed to Protect Workers and the General Public

1) Based on the results of risk assessments for postapplication workers and the general public, PMRA is proposing to cancel the following agricultural uses:
   - blueberry, highbush; blueberry, lowbush; celery, field; cherry (sweet and sour); chickpea; Cole crops; conifers (outdoor and nursery beds); corn, sweet; cranberry; evening primrose; lentil; nectarine; onion (dry and green); ornamentals (greenhouse and outdoor); pea, dry; peach; wheat; and turf (except for control of snow mould).

2) Based on the results of risk assessments for professional painters and homeowners applying chlorothalonil containing paints, the PMRA is proposing to cancel the material preservative use (paint).

3) Continued registration with mitigation is proposed for the following uses: asparagus, carrot, celery seedbeds, cucurbits, ginseng, mushroom, parsnip, potato, strawberry, tomato, and turf (for control of snow mould only) under the revised conditions of use:

   - For consistency between product labels: PPE consisting of coveralls over a single layer of clothing and chemical resistant gloves are proposed for workers during mixing/loading, and applying.

- A closed mixing/loading system when mixing and loading dry flowables/water dispersible granules in the amount exceeding 50 kg a.i. per day which corresponds to 55 kg of Echo 90 DF Agriculture Fungicide (Reg. No. 29356) and 60 kg of Bravo Ultrex (Reg. No. 29306).
- A closed mixing/loading system when mixing and loading liquid and dry flowable formulations for application to potato and turf.
- Groundboom equipment with an enclosed cab for applications to potato and turf.
- Reduction of the maximum application rate on celery seedbeds for dry flowables/water dispersible granules to 1.4 kg a.i./ha (current application rate approved for liquid formulation products).
- Reduction of the maximum number of applications per crop cycle:
  - Cucurbits– maximum two applications at a re-treatment interval of 7 days with a maximum application rate of 2.4 kg a.i./ha
  - Mushroom - one application per crops cycle at an application rate of 12.7 kg a.i./ha
  - Celery seedbeds – one application with a maximum application rate of 1.4 kg a.i./ha
  - Tomato and ginseng –one application with a maximum application rate of 2.4 kg a.i./ha
  - Potato – one application at a rate of 1.2 kg a.i./ha
- Reduction of the amount of chlorothalonil handled per day by a worker using a backpack sprayer for applications to turf to 2.0 kg a.i./ha which corresponds to approximately 0.17 ha (1700 m^2) at the application rate of 12 kg a.i./ha.
- New REIs to mitigate risks for workers entering treated sites to conduct postapplication activities.

4) In addition to mitigation measures identified above, additional PPE is proposed based on acute toxicity of end-use products:
   - A respiratory protection device for all workers involved in open mixing/loading and for applicators using hand-held equipment in enclosed spaces such as greenhouses and mushroom houses based on acute inhalation toxicity of end-use products containing chlorothalonil.
   - Protective eyewear (goggles or a face shield) for workers during mixing, loading, application, clean-up, maintenance, and repair based on eye irritation properties of end-use products containing chlorothalonil.

5) Additional label amendments:
   - Removal of a sprinkler irrigation application method for cucurbits and strawberries from the end-use product labels. Chlorothalonil as is unlikely to be applied to these crops using a sprinkler irrigation method.
   - A label statement "DO NOT APPLY BY AIR" for tomato. Aerial application is not expected for tomato.
   - A label statement prohibiting the use of products containing chlorothalonil on greenhouse-grown crops, unless clearly specified on the label (for example celery seedbeds).

- A label statement requiring the golf course superintendents to ensure that the general public will not be allowed to re-enter treated golf courses following the late fall application for control of snow mould.

The proposed label directions are listed in Appendix VII.

4.0 Amended Proposed Re-evaluation Decision

Based on the evaluation of available scientific information, the PMRA has determined that under the revised conditions of use, some uses of chlorothalonil do not present unacceptable risks to human health. These uses include asparagus, carrot, celery (seedbeds), cucurbits, ginseng, mushroom, parsnip, potato, strawberry, tomato, turf (for control of snow mould only). As a condition of continued registration of these uses, new risk-reduction measures must be included on the labels of chlorothalonil products (see Appendix VII).

Based on the human health risk assessment, the remaining uses of chlorothalonil are being proposed for cancellation. These uses include::

- Agricultural uses: blueberry, highbush; blueberry, lowbush; celery, field; cherry (sweet and sour); chickpea; Cole crops; conifers (outdoor and nursery beds); corn, sweet; cranberry; evening primrose; lentil; nectarine; onion (dry and green); ornamentals (greenhouse and outdoor); pea, dry; peach; wheat; and turf (except for control of snow mould);
- Material preservative use: paint.

List of Abbreviations

µg	microgram
a.i.	active ingredient
ADI	acceptable daily intake
ARfD	acute reference dose
ARI	aggregate risk index
ATPD	area treated per day
ARTF	Agricultural Re-Entry Task Force
bw	body weight
cm^2	centimetre(s) squared
C	commercial
CMA	Chemical Manufacturers Association
DACO	data code
DEEM	Dietary Exposure Evaluation Model
DFR	dislodgeable foliar residue
DIR	Regulatory Directive
FCID	Food Commodity Intake Database
FSFII	Continuing Surveys of Food Intakes by Individuals
ha	hectare
HCB	hexachlorobenzene
kg	kilogram(s)
L	litre(s)
LADD	lifetime average daily dose
LOAEL	lowest observed adverse effect level
LOC	level of concern
m^2	metre(s) squared
m^3	metre(s) cubed
MC	manufacturing concentrate
mg	milligram(s)
MRL	Maximum Residue Limit
MOE	margin of exposure
NAFTA	North American Free Trade Agreement
NOAEL	no observed adverse effect level
ORETF	Outdoor Residential Exposure Task Force
PHED	Pesticide Handlers Exposure Database
PHI	pre-harvest interval
PMRA	Pest Management Regulatory Agency
PPE	personal protective equipment
ppm	parts per million
PRVD	Proposed Re-evaluation Decision
PYO	pick-your-own
Q1*	cancer potency factor
REI	restricted-entry interval
REV	Re-evaluation Note
RTI	retreatment interval
T	technical
TC	transfer coefficient
TSMP	Toxic Substances Management Policy
TWA	time-weighted average
USEPA	United States Environmental Protection Agency

Appendix I Registered Chlorothalonil Products as of 24 December 24, 2015

Registration number	Marketing Class	Registrant	Product Name	Formulation Type	Guarantee
25574	T	GB Biosciences Corp.	Technical Chlorothalonil Fungicide	Solid	TET 98.5%
27059	T	Sipcam Agro USA, Inc.	Chlorothalonil Technical Fungicide	Solid	TET 98%
29354	T	Sipcam Agro USA, Inc.	Chlorothalonil Technical Ag	Solid	TET 99.3%
31763	T	Adama Agricultural Solutions Canada Ltd.	Adama Chlorothalonil Technical	Solid	TET 98.6%
24915	MC	Bayer Cropscience Inc.	Tattoo Manufacturing Use Product	Suspension	PHY 375 g/L TET 375 g/L
27540	MC	Syngenta Canada Inc.	Tuffcide N-40-D Manufacturing Concentrate	Solution	TET 40.4%
27541	MC	Syngenta Canada Inc.	Tuffcide N-96 Manufacturing Concentrate	Solid	TET 96%
15723	C	Syngenta Canada Inc.	Bravo 500 Agricultural Fungicide	Suspension	TET 500 g/L
15724	C	Syngenta Canada Inc.	Daconil 2787 Flowable Fungicide	Suspension	TET 500 g/L
16354	C	Syngenta Canada Inc.	Tuffcide N-96 Paint Microbiocide	Solid	TET 96%
18965	C	Syngenta Canada Inc.	Tuffcide N-40-D Paint Microbiocide	Solution	TET 40.4%
24544	C	Bayer Cropscience Inc.	Tattoo C Suspension Concentrate Fungicide	Suspension	PHY 375 g/L TET 375 g/L
26443	C	Syngenta Canada Inc.	Ridomil Gold Bravo Twin Pack Fungicide	Suspension	MFN 500 g/L TET 480 g/L
27057	C	Sostram Corporation	Clortram P-98M	Dust or Powder	TET 98%
27057.02	C	ISP Canada Corp.	Fungitrol 960s Fungicide	Dust or Powder	TET 98%
27057.03	C	ARCH CHEMICALS, INC	DENSIL C-98	Dust	98%
27058	C	Sostram Corporation	Clortram F-40	Suspension	TET 40.4%
27058.02	C	Buckman Laboratories Of Canada Ltd.	Busan 1192d Microbicide	Suspension	TET 40.4%

Registration number	Marketing Class	Registrant	Product Name	Formulation Type	Guarantee
27058.03	C	ISP Canada Corp.	Fungitrol 404-DS Fungicide	Suspension	TET 40.4%
28354	C	Syngenta Canada Inc.	Daconil Ultrex Fungicide	Wettable Granules	TET 82.5%
28861	C	Syngenta Canada Inc.	Instrata Fungicide	Suspension	FLD 14.5 g/L PON 57 g/L TET 362 g/L
28900	C	Syngenta Canada Inc.	Bravo Zn Agricultural Fungicide	Suspension	TET 500g/L
29225	C	Syngenta Canada Inc.	Bravo 720	Suspension	TET 720 g/L
29237	C	Syngenta Canada Inc.	Ridomil Gold Sl/Bravo 720 Twin-Pak	Suspension	MFN 480 g/L TET 720 g/L
29238	C	Syngenta Canada Inc.	Ridomil Gold/Bravo 720 Twin-Pak	Suspension	MFN 480 g/L TET 720 g/L
29239	C	Syngenta Canada Inc.	Ridomil Gold Sl/Bravo Twin-Pak	Solution	MFN 480 g/L TET 500 g/L
29306	C	Syngenta Canada Inc.	Bravo Ultrex	Wettable Granules	TET 82.5%
29355	C	Sipcam Agro USA, Inc.	Echo 720 Agricultural Fungicide	Suspension	TET 720 g/L
29356	C	Sipcam Agro USA, Inc.	Echo 90df Agricultural Fungicide	Dry Flowable	TET 90%
29642	C	Syngenta Canada Inc.	Concert Fungicide	Suspension	PON 35.7 g/L TET 473 g/L
29647	C	Rohm And Haas Canada LP	Rocima 404D Microbicide	Suspension	TET 40.4%
30165	C	Syngenta Canada Inc.	Daconil 720 Fungicide	Suspension	TET 720 g/L
30333	C	E.I. Du Pont Canada Company	Treoris Fungicide	Suspension	PNT 100 g/L TET 250 g/L
31537	C	Syngenta Canada Inc.	Bravo Top Fungicide	Suspension	DFZ 50 g/L TET 500 g/L
31552	C	Syngenta Canada Inc.	Ridomil Gold Sl/Bravo Zn Twin-Pak	Solution	MFN 480 g/L TET 500 g/L
32029	C	Adama Agricultural Solutions Canada Ltd.	Equus 82.5 DF	Dry Flowable	TET 82.5%
32030	C	Adama Agricultural Solutions Canada Ltd.	Chlorothalonil 720F	Suspension	TET 720 g/L

T – Technical active; MC – Manufacturing concentrate; C – Commercial

TET – chlorothalonil, PON - propiconazole; FLD - fludioxonil; PHY – propamocarb hydrochloride; MFN - metalaxyl; PNT - pentiopyrad; DFZ - difenconazole

Appendix II Currently Registered Chlorothalonil Use Pattern

Table 1 Agricultural Uses of Chlorothalonil

Crop	Application Rate (kg a.i./ha)[1]		Maximum Number of Applications Per Year	RTI (days)	PHI (days)	Application method
	Minimum	Maximum				
Asparagus	-	1.7 (SN) 1.2 (DF)	3	14	190	Groundboom
Blueberry, lowbush	-	3.6 (SN) 2.5 (DF)	2	42[2]	54	Groundboom, Modified airblast
Blueberry, highbush	-	3.6	3	7	54	Airblast Aerial
Carrot	1.2	1.6	7	7	1	Groundboom
Celery, field	0.8	2.0	9	3-8	7	Groundboom
Celery seedbeds	1.0	2.0 (DF) 1.4 (SN)	9	3	3	MPH Backpack sprayer Chemigation
Cherry (sweet and sour)	2.5	4.5	3	10	40	Airblast
Chickpea	1.0	2.0	3	10	14	Groundboom
Cole crops (Broccoli, Brussels sprouts, cabbage, cauliflower)	1.2	2.4	5	7	7	Groundboom
Corn, sweet	-	1.6	2	10	14	Groundboom Aerial
Cranberry	3.4	5.8	3	10	50	Chemigation
Cucurbits (for example, cucumber, water melon, summer and winter squash)	0.4 (SN) 1.2 (DF)	2.4	8	7	1	Groundboom
Evening primrose	-	1.2	2	14	Not stated	Groundboom
Ginseng	1.2	2.4	6	7	14	Groundboom
Hazelnuts[3] (filberts)		3.4	3	14	120	Airblast
Lentils	1.0	2.0	2	10	48	Groundboom Aerial
Mushroom	64 g/100m^2	127 g/100m^2	2 (per crop production cycle)	Not stated	7	MPH Backpack sprayer Chemigation
Onion, dry bulb	1.2	2.4	3	7	7	Groundboom
Onion, green	1.2	2.4	5	7	14	Groundboom
Parsnip	-	1.4	7	7	7	Groundboom

Crop	Application Rate (kg a.i./ha)[1]		Maximum Number of Applications Per Year	RTI (days)	PHI (days)	Application method
	Minimum	Maximum				
Potato	0.4	1.2	12	7	1	Groundboom Aerial
Strawberry	-	1.8	3	10	30	Groundboom
Pea, dry	1.0	1.5	3	10	32	Groundboom Aerial
Peach and nectarine	2.5	4.5	4	Not stated	60	Airblast
Tomato	1.2	2.4	9	8 - minimum rate 14 – maximum rate	1	Groundboom
Wheat	0.7	1.3	3	10	30	Groundboom Aerial

[1] Application rate according to current product labels; solution (SN) or dry flowable (DF) formulation

[2] Assuming 1st application in mid-June and 2nd application in early August; estimated RTI=6 weeks

[3] Chlorothalonil use on filbert (hazelnuts) trees is not considered in the current assessment given the existing up-to-date PMRA assessments

RTI – Re-Treatment Interval; PHI – Pre-Harvest Interval; MPH – Manually Pressurized Handwand; SN- solution; DF - dry flowable

Table 2 Ornamental and Conifer Uses of Chlorothalonil

Crop	Application Rate (kg a.i./ha)		Maximum Number of Applications per Production Cycle[1]	Minimum REI (days)	Application Method
	Minimum	Maximum			
	Outdoor				
Conifers	1.2	4.8	4	7	Airblast Groundboom MPH Backpack sprayer Irrigation system
Ornamentals	-	1.9[2] 2.5[3] 5.0[4]	23	7	MPH Backpack sprayer Irrigation system
	Greenhouse				
Conifers (nursery beds)	1.2	4.8	4	7	MPH Backpack sprayer Irrigation system
Ornamentals	-	1.9[2] 2.5[3] 5.0[4]	4	7	

[1] PRVD2011-14

[2] Roses only

[3] Pot, cut flowers (other than roses), other ornamentals

[4] Pachysandra only

MPH- Manually Pressurized Handwand

Table 3 Turf Uses of Chlorothalonil

Turf uses	Application[1] Rate (kg a.i./ha)	RTI (days)	Maximum annual application rate[2] (kg a.i./ha)	Maximum number of applications per year[3]	Application method
Tees	12.0	N/A	12.0	1	LP turfgun Backpack sprayer
	9.5	14	58.24	6	
	4.8	7		12	
Greens	12.0	N/A	12.0	1	Groundboom LP turfgun Backpack sprayer
	9.5	14	81.76	9	
	4.8	7		17	
Fairways	12.0	N/A	12.0	1	
	9.5	14	58.24	6	
	4.8	7		12	
Sod Farm	12.0	N/A	12.0	1	
	9.5	7	29.12	3	

[1] Application rate as per PRVD2011-14
[2] Maximum annual application rate as per PRVD2011-14
[3] Maximum number of applications per year = Maximum annual rate (kg a.i./ha) / Application rate(kg a.i./ha)
RTI – Re-treatment Interval; LP turf gun – Low Pressure turf gun

Table 4 Material Preservative Uses of Chlorothalonil

Material preservative	Application Rate (kg a.i./L)		Application method
	Minimum	Maximum	
Latex Emulsion Interior Paint	0.002	0.005	Primary Handlers: Open pour Closed mixing/loading system Secondary Handlers: Paintbrush (roller) Airless sprayer
Latex Emulsion Exterior Paint	0.004	0.010	
Solvent-Based Exterior Paint	0.005	0.012	

Appendix III Toxicological Endpoints for Human Health Risk Assessment

Exposure Scenario	Dose (mg/kg bw/day)	Study	CAF or Target MOE or LOC[1]
Acute dietary (including PYO scenario)	LOAEL = 175	90-day special feeding study in rats; squamous hyperplasia and hyperkeratosis in the forestomach and degenerative kidney changes characterized by vacuolation in the proximal convoluted tubules observed beginning on Day 4 at 175 mg/kg bw/day	300
	ARfD[2] = 0.58 mg/kg bw/day		
Chronic dietary (all populations)	NOAEL = 1.5	2-year study in rats; kidney (focal epithelial hyperplasia, karyomegaly, clear cell hyperplasia, interstitial fibrosis, cortical cysts and chronic progressive nephropathy) and stomach (squamous epithelial hyperplasia and hyperkeratosis of the fore stomach and erosion and ulceration of the glandular and nonglandular stomach) effects at ≥ 3.3 mg/kg bw/day (males)	100
	ADI = 0.015 mg/kg bw/day		
Acute dermal (PYO scenario)	NOAEL = 600	21-day dermal study in rats; no adverse effects observed up to and including the highest dose tested	100
Short-, intermediate, long-term dermal and inhalation	NOAEL= 1.5	90-day dietary study in rats; increased relative kidney weights (to body weight) and kidney pathology (an increased incidence of irregular intracytoplasmic inclusion bodies in the proximal convoluted tubules cells in kidneys of males) observed at ≥ 3 mg/kg/bw/day and dose-related increase in hyperplasia hyperkeratosis of the gastric epithelium in both sexes at ≥ 10 mg/kg bw/day; 2-year rat dietary study: kidney (focal epithelial hyperplasia, karyomegaly, clear cell hyperplasia, interstitial fibrosis, cortical cysts and chronic progressive nephropathy) and stomach (squamous epithelial hyperplasia and hyperkeratosis of the fore stomach and erosion and ulceration of the glandular and nonglandular stomach) effects at ≥ 3.3 mg/kg bw/day (males)	100
Non-dietary oral (children)			
Aggregate golfer			
Cancer Risk	$q_1^* = 7.66 \times 10^{-3}$ $(mg/kg\ bw/day)^{-1}$	2-year study in rats; based on incidences of renal tumours (adenoma and carcinoma) in female rats	Residential 1×10^{-6} Occupational 1×10^{-5}

NOAEL – No Observed Adverse Effect Level; LOAEL – Lowest Observed Adverse Effect Level; PYO – Pick-Your-Own

Dermal absorption is considered to be 19% of the oral dose based on dermal absorption studies and inhalation absorption is considered to be 100% (default) of the oral dose.

1 CAF (composite assessment factor) for dietary assessments or MOE (Margin of Exposure) for occupational/residential assessments or LOC (Level of Concern) for cancer assessments; 100 (uncertainty factors of a 10-fold for interspecies extrapolation and 10-fold for intraspecies variations) and 300 (uncertainty factors of a 10-fold for interspecies extrapolation and 10-fold for intraspecies variations; 3 fold for LOAEL to NOAEL extrapolation)

2 Reference Dose (ARfD) previously used for the PMRA acute dietary risk assessment in PRVD2011-14

Appendix IV Occupational Mixer/Loader/Applicator Exposure and Risk Assessment

Table 1 Non-cancer and Cancer Exposure and Risk Assessment for a Mixer/Loader/Applicator Using Groundboom Equipment

Crop	EP	PPE/engineering controls	Application rate[1] (kg a.i./ha)	Non-cancer ATPD[2] (ha/day)	Combined UE[3] (mg/kg a.i.)	Daily exposure dose[4] (mg/kg bw/day)	ST/IT MOE[5]	Cancer ATPD[2] (ha/day)	LADD[6] (mg/kg bw/day)	Cancer risk[7]
Chickpea	DF	Closed mixing/loading, M/L/A wearing coveralls and gloves, open cab	2.0	64	0.00681	0.0109	138	64	4.6×10^{-4}	4×10^{-6}
	SN				0.00689	0.0110	136		4.6×10^{-4}	4×10^{-6}
Corn, sweet	DF	Closed mixing/loading, M/L/A wearing coveralls, M/L wearing gloves, enclosed cab: A no gloves	1.60	135	0.00275	0.0075	200	80	1.9×10^{-4}	1×10^{-6}
	SN				0.00284	0.0077	195		2.0×10^{-4}	2×10^{-6}
Lentils	DF	Closed mixing/loading, M/L/A wearing chemical resistant coveralls, M/L wearing gloves, enclosed cab: A no gloves	2.0	360	0.00222	0.0201	**75**	240	5.7×10^{-4}	4×10^{-6}
	SN				0.00223	0.0201	**75**		5.7×10^{-4}	4×10^{-6}
	DF		2.0	**269**	0.00222	0.0150	100	240	5.7×10^{-4}	4×10^{-6}
	SN				0.00223	0.0150	100		5.7×10^{-4}	4×10^{-6}
Pea, dry	DF	Closed mixing/loading, M/L/A wearing coveralls, M/L wearing gloves, enclosed cab: A no gloves	1.5	240	0.00275	0.0124	121	240	5.3×10^{-4}	4×10^{-6}
	SN				0.00284	0.0128	117		5.4×10^{-4}	4×10^{-6}
Potato	DF	Closed mixing/loading, M/L/A wearing coveralls, M/L wearing gloves; enclosed cab: A no gloves	1.2	360	0.00275	0.0149	101	240	4.28×10^{-4}	3×10^{-6}
	SN				0.00284	0.0154	**97**		4.4×10^{-4}	3×10^{-6}
Wheat	DF	Closed mixing/loading, M/L/A wearing chemical resistant coveralls, M/L wearing gloves, enclosed cab: A no gloves	1.3	360	0.00222	0.0131	115	240	3.7×10^{-4}	3×10^{-6}
	SN				0.00223	0.0131	115		3.7×10^{-4}	3×10^{-6}

Crop	EP	PPE/engineering controls	Application rate[1] (kg a.i./ha)	Non-cancer ATPD[2] (ha/day)	Combined UE[3] (mg/kg a.i.)	Daily exposure dose[4] (mg/kg bw/day)	ST/IT MOE[5]	Cancer ATPD[2] (ha/day)	LADD[6] (mg/kg bw/day)	Cancer risk[7]
Asparagus	DF	Closed mixing/loading, M/L/A wearing a single layer of clothing and gloves, open cab	1.2	26	0.01035	0.0041	366	12	8.0×10^{-5}	6×10^{-7}
		Open mixing/loading, M/L/A wearing coveralls and gloves, open cab			0.02345	0.0092	163		1.8×10^{-4}	1×10^{-6}
	SN	Open mixing/loading; M/L/A wearing a single layer of clothing and gloves, open cab	1.7		0.01845	0.0102	147		2.0×10^{-4}	2×10^{-6}
Carrot	DF	Closed mixing/loading, M/L/A wearing a single layer of clothing and gloves, open cab	1.6	26	0.01035	0.0054	278	12	1.1×10^{-4}	8×10^{-7}
		Open mixing/loading, M/L/A wearing coveralls and gloves, open cab			0.02345	0.0122	123		2.4×10^{-4}	2×10^{-6}
	SN	Open mixing/loading; M/L/A wearing a single layer of clothing and gloves, open cab			0.01845	0.0096	156		1.9×10^{-4}	1×10^{-6}
Cole crops, onion, tomato, cucurbits, ginseng	DF	Closed mixing/loading, M/L/A wearing a single layer of clothing and gloves, open cab	2.4	26	0.01035	0.0081	185	12	1.6×10^{-4}	1×10^{-6}
		Open mixing/loading, M/L/A wearing coveralls and gloves, open cab		**21**	0.02345	0.0148	101		3.6×10^{-4}	3×10^{-6}
	SN	Open mixing/loading; M/L/A wearing a single layer of clothing and gloves, open cab	2.4	26	0.01845	0.0144	104		2.8×10^{-4}	2×10^{-6}
Evening primrose	DF	Open mixing/loading, M/L/A wearing a coveralls and gloves, open cab	1.2	26	0.02345	0.0092	163	12	1.8×10^{-4}	1×10^{-6}

Crop	EP	PPE/engineering controls	Application rate[1] (kg a.i./ha)	Non-cancer ATPD[2] (ha/day)	Combined UE[3] (mg/kg a.i.)	Daily exposure dose[4] (mg/kg bw/day)	ST/IT MOE[5]	Cancer ATPD[2] (ha/day)	LADD[6] (mg/kg bw/day)	Cancer risk[7]
	SN	Open mixing/loading; M/L/A wearing a single layer of clothing and gloves, open cab			0.01845	0.0072	208		1.4×10^{-4}	1×10^{-6}
Parsnip	DF	Closed mixing/loading, M/L/A wearing a single layer of clothing and gloves, open cab	1.4	26	0.01035	0.0048	313	12	1.0×10^{-4}	8×10^{-7}
		Open mixing/loading, M/L/A wearing a coveralls and gloves, open cab			0.02345	0.0107	140		2.1×10^{-4}	2×10^{-6}
	SN	Open mixing/loading; M/L/A wearing a single layer of clothing and gloves, open cab			0.01845	0.0084	179		1.7×10^{-4}	1×10^{-6}
Blueberry, lowbush	DF	Closed mixing/loading, M/L/A wearing coveralls and gloves, open cab	2.5	61	0.00681	0.0130	115	61	5.5×10^{-4}	4×10^{-6}
	SN	Closed mixing/loading, M/L/A wearing coveralls, M/L wearing gloves, enclosed cab: A no gloves	3.6		0.00284	0.0078	192		3.3×10^{-4}	3×10^{-6}
Strawberry	DF	Closed mixing/loading, M/L/A wearing a single layer of clothing and gloves, open cab	1.8	26	0.01035	0.0061	246	12	1.2×10^{-4}	9×10^{-7}
		Open mixing/loading, M/L/A wearing a coveralls and gloves, open cab			0.02345	0.0138	109		2.7×10^{-4}	2×10^{-6}
	SN	Open mixing/loading; M/L/A wearing a single layer of clothing and gloves, open cab			0.01845	0.0108	139		2.1×10^{-4}	2×10^{-6}
Conifers – nursery beds	DF	Closed mixing/loading, M/L/A wearing coveralls and gloves, open cab	4.8	26	0.00681	0.0107	140	12	3.5×10^{-4}	3×10^{-6}
	SN				0.00689	0.0108	139		3.5×10^{-4}	3×10^{-6}

Crop	EP	PPE/engineering controls	Application rate[1] (kg a.i./ha)	Non-cancer ATPD[2] (ha/day)	Combined UE[3] (mg/kg a.i.)	Daily exposure dose[4] (mg/kg bw/day)	ST/IT MOE[5]	Cancer ATPD[2] (ha/day)	LADD[6] (mg/kg bw/day)	Cancer risk[7]
Turf – sod farm	DF	Closed mixing/loading, M/L/A wearing coveralls, M/L wearing gloves; enclosed cab: A no gloves	9.5	30	0.00275	0.0098	153	30	4.2×10^{-4}	3×10^{-6}
	SN				0.00284	0.0102	147		4.3×10^{-4}	3×10^{-6}
Turf - Golf course	DF	Closed mixing/loading, M/L/A wearing a coveralls and gloves, open cab		16	0.00681	0.0130	115	16	5.5×10^{-4}	4×10^{-6}
	SN				0.00689	0.0131	115		5.6×10^{-4}	4×10^{-6}
Turf – sod farm	DF	Closed mixing/loading, M/L/A wearing coveralls M/L wearing gloves, enclosed cab: A no gloves	12.0 (snow mould)	30	0.00275	0.0124	121	30	2.0×10^{-5}	2×10^{-7}
	SN				0.00284	0.0128	117		2.0×10^{-5}	2×10^{-7}
Turf - Golf course	DF	Closed mixing/loading, M/L/A wearing a single layer of clothing, M/L wearing gloves, enclosed cab: A no gloves		16	0.00537	0.0129	116	16	2.0×10^{-5}	2×10^{-7}
	SN				0.00587	0.0141	106		2.0×10^{-5}	2×10^{-7}

1 Application rate (kg a.i./ha) according to current labels except for turf application (PRVD2011-14)

2 Area Treated per Day (ATPD) – default value unless use-specific information available

3 Combined UE (mg/kg a.i.) – Combined Unit Exposure (UE) = Dermal plus inhalation UE (PHED) accounting for 19% dermal absorption

4 Daily exposure dose (mg/kg bw/day) = Combined UE (mg/kg a.i.) × Application rate (kg a.i./ha) × Non-cancer ATPD (ha) /Average worker body weight (80 kg)

5 ST/IT MOE = ST/IT NOAEL of 1.5 mg/kg bw/day/Daily exposure dose (mg/kg bw/day); target MOE of 100

6 LADD (mg/kg bw/day) = Combined UE (mg/kg a.i.) × Application rate (kg a.i./ha) × Cancer ATPD (ha) /Average worker body weight (80 kg) × Frequency (days /year=365 days) × Career duration (40 years/lifetime=78 years); Frequency of applications 30 days per year, except for use on turf to control snow mould, at a rate of 12 kg a.i./ha, where a single application per year was assumed

7 Cancer risk = LADD (mg/kg bw/day) × q_1^* of 7.66×10^{-3} (mg/kg bw/day)$^{-1}$; occupational LOC> 1×10^{-5}

Shaded cells indicate risks of concern; Patterned cells indicate the required mitigation measure in order to reach the acceptable MOE; EP – end-use product formulation: DF – dry flowable, SN – solution; M/L – mixer/loader; A - applicator

Table 2 Non-cancer and Cancer Exposure and Risk Assessment for Mixer/Loader/Applicators Using Airblast Equipment

Crop	EP	PPE/engineering controls	Application rate[1] (kg a.i./ha)	Non-cancer ATPD[2] (ha/day)	Combined UE[3] (mg/kg a.i.)	Daily exposure dose[4] (mg/kg bw/day)	ST/IT MOE[5]	Cancer ATPD[2] (ha/day)	LADD[6] (mg/kg bw/day)	Cancer risk[7]
Blueberry, highbush	DF	Closed mixing/loading, M/L wearing coveralls and gloves; A wearing a single layer of clothing and gloves, enclosed cab	3.6	31	0.01036	0.0145	103	31	6.1×10^{-4}	5×10^{-6}
	SN				0.01045	0.0146	103		6.2×10^{-4}	5×10^{-6}
Blueberry, lowbush	DF	Closed mixing/loading, M/L/A wearing chemical resistant coveralls, M/L wearing gloves, enclosed cab: A no gloves	3.6	40	0.00939	0.0169	**89**	40	7.2×10^{-4}	6×10^{-6}
	SN				0.00939	0.0170	**88**		7.2×10^{-4}	6×10^{-6}
Cherry (sweet and sour) Peach Nectarine	DF	Closed mixing/loading, M/L/A wearing a single layer and gloves, enclosed cab	4.5	10	0.01173	0.0066	227	10	2.8×10^{-4}	2×10^{-6}
	SN	Open mixing loading, M/L/A wearing a single layer of clothing and gloves, enclosed cab			0.01983	0.0112	134		4.8×10^{-4}	4×10^{-6}
Conifers	DF	Closed mixing/loading, M/L/A wearing a single layer of clothing and gloves, enclosed cab	4.8	20	0.01173	0.0141	106	7	3.5×10^{-4}	3×10^{-6}
	SN				0.01222	0.0147	102		3.7×10^{-4}	3×10^{-6}

1 Application rate (kg a.i./ha) according to current labels

2 Area Treated per Day (ATPD) – default value unless use-specific information available

3 Combined UE (mg/kg a.i.) – Combined Unit Exposure (UE) = Dermal plus inhalation UE (PHED) accounting for 19% dermal absorption

4 Daily exposure dose (mg/kg bw/day) = Combined UE (mg/kg a.i.) × Application rate (kg a.i./ha) × Non-cancer ATPD (ha) /Average worker body weight (80 kg)

5 ST/IT MOE = ST/IT NOAEL of 1.5 mg/kg bw/day/Daily exposure dose (mg/kg bw/day); target MOE of 100

6 LADD (mg/kg bw/day) = Combined UE (mg/kg a.i.) × Application rate (kg a.i./ha) × Cancer ATPD (ha) /Average worker body weight (80 kg) × Frequency (30 days /year=365 days) × Career duration (40 years/lifetime=78 years)

7 Cancer risk = LADD (mg/kg bw/day) × q_1* of 7.66×10^{-3} $(mg/kg\ bw/day)^{-1}$; occupational LOC> 1×10^{-5}

EP – end-use product formulation: DF – dry flowable, SN – solution, M/L – mixer/loader; A – applicator

Table 3 Non-cancer and Cancer Exposure and Risk Assessment for a Worker Mixing/Loading for Aerial and Chemigation Application

Crop	Scenario	EP	PPE/engineering controls	Application rate[1] (kg a.i./ha)	Non-cancer ATPD[2] (ha)	Combined UE[3] (mg/kg a.i.)	Daily exposure dose[4] (mg/kg bw/day)	ST/IT MOE[5]	Cancer ATPD[2] (ha/day)	LADD[6] (mg/kg bw/day)	Cancer risk[7]
Blueberry, highbush	M/L for aerial application	DF	Closed mixing/loading, M/L wearing coveralls and gloves	3.6	400	0.00158	0.0284	**53**	318	9.6×10^{-4}	7×10^{-6}
		SN				0.00158	0.0285	**53**		9.6×10^{-4}	7×10^{-6}
	Aerial application - spray		A wearing a single layer clothing and no gloves			0.00191	0.0343	**44**	318	1.2×10^{-3}	9×10^{-6}
	M/L for aerial application	DF	Closed mixing/loading, M/L wearing coveralls and gloves		**174**	0.00185	0.0145	103	**174**	6.2×10^{-4}	5×10^{-6}
		SN	Closed mixing/loading, M/L wearing chemical-resistant coveralls and gloves			0.00158	0.0124	121		5.3×10^{-4}	4×10^{-6}
	Aerial application - spray		A wearing a single layer clothing and no gloves			0.00191	0.0150	100		6.3×10^{-4}	5×10^{-6}
Lentil	M/L for aerial application	DF	Closed mixing/loading, M/L wearing chemical-resistant coveralls and gloves	2.0	400	0.00158	0.0158	**95**	318	5.3×10^{-4}	4×10^{-6}
		SN				0.00158	0.0159	**94**		5.3×10^{-4}	4×10^{-6}
	Aerial application - spray		A wearing a single layer of clothing and no gloves			0.00191	0.0191	**79**		6.4×10^{-4}	5×10^{-6}
	M/L for aerial application	DF	Closed mixing/loading, M/L wearing coveralls and gloves	2.0	**314**	0.00185	0.0146	103	**314**	6.2×10^{-4}	5×10^{-6}
		SN	Closed mixing/loading, M/L wearing chemical-resistant coveralls and gloves			0.00158	0.0125	120		5.3×10^{-4}	4×10^{-6}
	Aerial application - spray		A wearing a single layer of clothing and no gloves			0.00191	0.0150	100		6.4×10^{-4}	5×10^{-6}

Crop	Scenario	EP	PPE/engineering controls	Application rate[1] (kg a.i./ha)	Non-cancer ATPD[2] (ha)	Combined UE[3] (mg/kg a.i.)	Daily exposure dose[4] (mg/kg bw/day)	ST/IT MOE[5]	Cancer ATPD[2] (ha/day)	LADD[6] (mg/kg bw/day)	Cancer risk[7]
Pea, dry	M/L for aerial application	DF	Closed mixing/loading, M/L wearing coveralls and gloves	1.5	400	0.00185	0.0139	108	318	4.7×10^{-4}	4×10^{-6}
		SN				0.00194	0.0146	103		4.9×10^{-4}	4×10^{-6}
	Aerial application - spray		A wearing a single layer of clothing, no gloves			0.00191	0.0143	105		4.8×10^{-4}	4×10^{-6}
Potato	M/L for aerial application	DF	Closed mixing/loading, M/L wearing coveralls and gloves	1.2	400	0.00185	0.0111	135	318	3.8×10^{-4}	3×10^{-6}
		SN				0.00194	0.0117	128		3.9×10^{-4}	3×10^{-6}
	Aerial application - spray		A wearing a single layer of clothing, no gloves			0.00191	0.0115	130		3.9×10^{-4}	3×10^{-6}
Corn, sweet	M/L for aerial application	DF	Closed mixing/loading, M/L wearing coveralls and gloves	1.6	400	0.00185	0.0148	101	318	5.0×10^{-4}	4×10^{-6}
		SN	Closed mixing/loading, M/L wearing chemical-resistant coveralls and gloves			0.00158	0.0127	118		4.3×10^{-4}	3×10^{-6}
	Aerial application - spray		A wearing a single layer of clothing, no gloves			0.0191	0.0153	**98**		5.2×10^{-4}	4×10^{-6}
					393	0.0191	0.0150	100		5.2×10^{-4}	4×10^{-6}
Wheat	M/L for aerial application	DF	Closed mixing/loading, M/L wearing coveralls and gloves	1.3	400	0.00185	0.0121	124	318	4.1×10^{-4}	3×10^{-6}
		SN				0.00194	0.0126	119		4.3×10^{-4}	3×10^{-6}
	Aerial application – spray		A wearing a single layer of clothing and no gloves			0.00191	0.0124	121		4.2×10^{-4}	3×10^{-6}
Cranberry	M/L for chemigation	DF	Closed mixing/loading, M/L wearing coveralls and gloves	5.8	100	0.00185	0.0135	111	100	5.7×10^{-4}	4×10^{-6}
		SN				0.00194	0.0141	106		6.0×10^{-4}	5×10^{-6}

Crop	Scenario	EP	PPE/engineering controls	Application rate[1] (kg a.i./ha)	Non-cancer ATPD[2] (ha)	Combined UE[3] (mg/kg a.i.)	Daily exposure dose[4] (mg/kg bw/day)	ST/IT MOE[5]	Cancer ATPD[2] (ha/day)	LADD[6] (mg/kg bw/day)	Cancer risk[7]
	Applicator - Chemigation		Exposure expected to be negligible								

1 Application rate (kg a.i./ha) according to current labels

2 Area Treated per Day (ATPD) – default value except for cranberry

3 Combined UE (mg/kg a.i.) – Combined Unit Exposure (UE) = Dermal plus inhalation UE (PHED) accounting for 19% dermal absorption

4 Daily exposure dose (mg/kg bw/day) = Combined UE (mg/kg a.i.) × Application rate (kg a.i./ha) × Non-cancer ATPD (ha) /Average worker body weight (80 kg)

5 ST/IT MOE = ST/IT NOAEL of 1.5 mg/kg bw/day/Daily exposure dose (mg/kg bw/day); target MOE of 100

6 LADD (mg/kg bw/day) = Combined UE (mg/kg a.i.) × Application rate (kg a.i./ha) × Cancer ATPD (ha) /Average worker body weight (80 kg) × Frequency (30 days/year=365 days) × Career duration (40 years/lifetime=78 years)

7 Cancer risk = LADD (mg/kg bw/day) × q_1* of 7.66 × 10^{-3} (mg/kg bw/day)$^{-1}$; occupational LOC> 1 × 10^{-5}

Shaded cells indicate risks of concern; Patterned cells indicate the required mitigation measure (reduced area treated per day) in order to reach the acceptable MOE; EP – end-use product formulation: DF – dry flowable, SN – solution, M/L – mixer/loader; A - applicator

Table 4 Non-cancer and Cancer Exposure and Risk Assessment for Greenhouse/Nursery Workers

Crop	Scenario		PPE/ engineering controls	Application rate[1] (kg a.i./ha or kg a.i./L*)	ATPD[2] (ha or L* per day)	Combined UE[3] (mg/kg a.i.)	Daily exposure dose[4] (mg/kg bw/day)	ST/IT MOE[5]	Cancer ATPD[2] (ha or L* per day)	LADD[6] (mg/kg bw/day)	Cancer risk[7]
Mushroom (mushroom house)	M/L/A using manually-pressurized handgun	DF	Open mixing/loading, M/L/A wearing a single layer of clothing, and gloves	12.7	0.015	0.2735	0.0007	2143	150*	5.0×10^{-5}	4×10^{-7}
		SN	M/L/A wearing a single layer of clothing and gloves			0.2413	0.0006	2500		5.0×10^{-5}	4×10^{-7}
	M/L/A using backpack	DF	Open mixing/loading; M/L/A wearing a single layer of clothing and gloves			1.1289	0.0027	556	150*	1.9×10^{-4}	1×10^{-6}
		SN	M/L/A wearing a single layer of clothing and gloves			1.0968	0.0027	556		1.9×10^{-4}	1×10^{-6}
	M/L for chemigation	DF	Open mixing/loading; M/L wearing a single layer of clothing and gloves		0.27	0.2467	0.0106	142	0.27	7.5×10^{-4}	6×10^{-6}
		SN	M/L wearing a single layer of clothing and gloves			0.0783	0.0034	441		2.4×10^{-4}	2×10^{-6}

Crop	Scenario		PPE/ engineering controls	Application rate[1] (kg a.i./ha or kg a.i./L*)	ATPD[2] (ha or L* per day)	Combined UE[3] (mg/kg a.i.)	Daily exposure dose[4] (mg/kg bw/day)	ST/IT MOE[5]	Cancer ATPD[2] (ha or L* per day)	LADD[6] (mg/kg bw/day)	Cancer risk[7]
	Applicator - Chemigation		Exposure expected to be negligible								
Celery, seedbeds (greenhouse)	M/L/A using manually-pressurized handgun	DF	Open mixing/loading, M/L/A wearing a single layer of clothing and gloves	2.0	0.081	0.2735	0.0006	2500	0.081	4.0×10^{-5}	3×10^{-7}
		SN	M/L/A wearing a single layer of clothing and gloves	1.4		0.2413	0.0004	3750		3.0×10^{-5}	2×10^{-7}
	M/L/A using backpack sprayer	DF	Open mixing/loading; M/L/A wearing a single layer of clothing and gloves	2.0		1.1289	0.0023	652		1.7×10^{-4}	1×10^{-6}
		SN	M/L/A wearing over a single layer of clothing and gloves	1.4		1.0968	0.0016	938		1.1×10^{-4}	8×10^{-7}
	M/L for chemigation	DF	Open mixing/loading; M/L wearing a single layer of clothing and gloves	2.0		0.0321	0.00010	15000		1.0×10^{-5}	8×10^{-8}
		SN	M/L wearing a single layer of clothing and gloves	1.4		0.0113	0.00010	15000		1.0×10^{-5}	8×10^{-8}
	Applicator - Chemigation		Exposure expected to be negligible								
Greenhouse and outdoor ornamentals	M/L/A using manually-pressurized handgun	DF	Open mixing/loading, M/L/A wearing a single layer of clothing and gloves	0.0025*	150*	0.2735	0.0013	1154	150 L	9.1×10^{-5}	7×10^{-7}
		SN	M/L/A wearing a single layer of clothing and gloves			0.2413	0.0012	1250		8.0×10^{-5}	6×10^{-7}
	M/L/A using backpack sprayer	DF	Open mixing/loading, M/L/A wearing a single layer of clothing and gloves	0.0025*	150*	1.1289	0.0053	283	150 L	3.8×10^{-4}	3×10^{-6}
		SN	M/L/A wearing a single layer of clothing and gloves			1.0968	0.0052	288		3.7×10^{-4}	3×10^{-6}
Greenhouse ornamentals	M/L for chemigation	DF	Open mixing/loading; M/L wearing coveralls and gloves	5.0	1.1	0.1389	0.0096	157	0.06	3.7×10^{-5}	3×10^{-7}
		SN	Open mixing/loading: M/L wearing a single layer of clothing and gloves			0.0783	0.0054	278		2.1×10^{-5}	2×10^{-7}
		DF	Open mixing/loading: M/L wearing a single layer	2.5		0.2467	0.0085	177		3.3×10^{-5}	3×10^{-7}

Crop	Scenario		PPE/ engineering controls	Application rate[1] (kg a.i./ha or kg a.i./L*)	ATPD[2] (ha or L* per day)	Combined UE[3] (mg/kg a.i.)	Daily exposure dose[4] (mg/kg bw/day)	ST/IT MOE[5]	Cancer ATPD[2] (ha or L* per day)	LADD[6] (mg/kg bw/day)	Cancer risk[7]
		SN	of clothing and gloves			0.0783	0.0027	556		1.1×10^{-5}	8×10^{-8}
Outdoor ornamentals	M/L for chemigation	DF	Closed mixing/loading; M/L wearing coveralls and gloves	5	12	0.0139	0.0105	143	1.2	7.4×10^{-5}	6×10^{-7}
		SN				0.0145	0.0109	138		7.7×10^{-5}	6×10^{-7}
		DF	Closed mixing/loading; M/L wearing a single layer of clothing and gloves	2.5		0.0247	0.0093	161		6.5×10^{-5}	5×10^{-7}
		SN				0.0285	0.0108	139		7.6×10^{-5}	6×10^{-7}
Greenhouse and outdoor ornamentals	Applicator - Chemigation		Exposure expected to be negligible								
Conifers - (nursery beds)	M/L/A using manually-pressurized handgun	DF	Open mixing/loading. M/L wearing coverall and gloves; Applicator wearing coveralls, gloves, and a respirator	4.8	1.5	0.1644	0.0148	101	1.5	1.0×10^{-3}	8×10^{-6}
		SN	M/L/A wearing coveralls, gloves, and a respirator			0.1459	0.0132	114		9.3×10^{-4}	7×10^{-6}
	M/L/A using backpack sprayer	DF	Closed mixing/loading; M/L wearing chemical resistant coveralls and gloves; Applicator wearing chemical resistant coveralls, gloves, and a respirator	4.8	1.5	0.3930	0.0354	**42**		2.5×10^{-3}	$\mathbf{2 \times 10^{-5}}$
		SN	M/L/A wearing chemical resistant coveralls, gloves and a respirator			0.3914	0.0353	**42**		2.5×10^{-3}	$\mathbf{2 \times 10^{-5}}$
		DF	Closed mixing/loading; M/L wearing chemical resistant coveralls and gloves; Applicator wearing chemical resistant coveralls, gloves, and a respirator	**2.0**	1.5	0.3930	0.0148	101		1.0×10^{-3}	8×10^{-6}
		SN	M/L/A wearing chemical resistant coveralls, gloves, and a respirator			0.3914	0.0147	102		1.0×10^{-3}	8×10^{-6}
	M/L for chemigation	DF	Open mixing/loading; M/L wearing a single layer of clothing and gloves	4.8	1.5	0.0321	0.0029	517		2.1×10^{-4}	2×10^{-6}

Crop	Scenario		PPE/ engineering controls	Application rate[1] (kg a.i./ha or kg a.i./L*)	ATPD[2] (ha or L* per day)	Combined UE[3] (mg/kg a.i.)	Daily exposure dose[4] (mg/kg bw/day)	ST/IT MOE[5]	Cancer ATPD[2] (ha or L* per day)	LADD[6] (mg/kg bw/day)	Cancer risk[7]
		SN	M/L wearing a single layer of clothing and gloves			0.0113	0.0011	1364		8.0×10^{-5}	6×10^{-7}
	Applicator - Chemigation		Exposure expected to be negligible								

1 Application rate (kg a.i./ha) according to current labels

2 Area Treated per Day (ATPD) – default value unless use-specific information available

3 Combined UE (mg/kg a.i.) – Combined Unit Exposure (UE) = Dermal plus inhalation UE (PHED) accounting for 19% dermal absorption

4 Daily exposure dose (mg/kg bw/day) = Combined UE (mg/kg a.i.) × Application rate (kg a.i./ha or kg a.i./L) × Non-cancer ATPD (ha or L) /Average worker body weight (80 kg)

5 ST/IT MOE = ST/IT/LT NOAEL of 1.5 mg/kg bw/day/Daily exposure dose (mg/kg bw/day); target MOE of 100

6 LADD (mg/kg bw/day) = Combined UE (mg/kg a.i.) × Application rate (kg a.i./ha or kg a.i./L) × Cancer ATPD (ha or L) /Average worker body weight (80 kg) × Frequency (50 days/ year=365 days) × Career duration (40 years/lifetime=78 years)

7 Cancer Risk = LADD (mg/kg bw/day) × q_1* of 7.66×10^{-3} $(mg/kg\ bw/day)^{-1}$; occupational LOC> 1×10^{-5}

Shaded cells indicate risks of concern; Pattern shaded cells indicate the required mitigation measure (reduced application rate) in order to reach the acceptable MOE; EP – end-use product formulation: DF – dry flowable, SN – solution, M/L – mixer/loader; A - applicator

Table 5 Non-cancer and Cancer Exposure and Risk Assessment for a Mixer/Loader/Applicator Using Handheld Equipment for Turf Treatment

Scenario	EP	PPE/ engineering controls	Application rate[1] (kg a.i./ha)	Non-cancer and cancer ATPD[2] (ha/day)	Combined UE[3] (mg/kg a.i.)	Daily exposure dose[4] (mg/kg bw/day)	ST/IT MOE[5]	LADD[6] (mg/kg bw/day)	Cancer risk[7]
M/L/A using turf gun	DF	M/L/A wearing coveralls and gloves	12.0	0.375	0.130 (a) 0.289 (b)	0.0073	205	2.3×10^{-8}	2×10^{-10}
	SN	M/L/A wearing a single layer of clothing and gloves			0.153 (a) 0.403 (b)	0.0086	174	3.2×10^{-8}	2×10^{-10}
	DF	M/L/A wearing a single layer of clothing and gloves	9.5		0.293 (a) 0.842 (b)	0.0131	115	1.6×10^{-6}	1×10^{-8}
	SN				0.153 (a) 0.403 (b)	0.0068	220	7.6×10^{-7}	6×10^{-9}
M/L/A using backpack sprayer	DF	Closed mixing/loading; M/L wearing chemical resistant coveralls and gloves; Applicator wearing chemical resistant coveralls, gloves, and a respirator	12.0	0.375	0.3930	0.0222	**68**	3.2×10^{-5}	2×10^{-7}
	SN	M/L/A wearing chemical resistant coveralls, gloves, and a respirator			0.3914	0.0221	**68**	3.1×10^{-5}	2×10^{-7}
	DF	Closed mixing/loading; M/L wearing chemical resistant coveralls and gloves; Applicator wearing chemical resistant coveralls, gloves, and a respirator	9.5		0.3930	0.0175	**86**	7.4×10^{-4}	6×10^{-6}
	SN	M/L/A wearing chemical resistant coveralls and gloves			0.3914	0.0175	**86**	7.4×10^{-4}	6×10^{-6}
	DF	Open mixing/loading; M/L/A wearing coveralls and gloves	4.8		0.5740	0.0130	115	5.5×10^{-4}	4×10^{-6}
	SN	M/L/A wearing coveralls and gloves			0.5555	0.0125	120	5.3×10^{-4}	4×10^{-6}

1 Application rate (kg a.i./ha) according to current labels

2 Area Treated per Day (ATPD) based on use-specific information

3 Combined UE (mg/kg a.i.) – Combined Unit Exposure (UE) = Dermal plus inhalation UE accounting for 19% dermal absorption; (a) ORETF median for non-cancer assessment, (b) ORETF arithmetic mean for cancer assessment

4 Daily exposure dose (mg/kg bw/day) = Combined UE (mg/kg a.i.) × Application rate (kg a.i./ha) × ATPD (ha) /Average worker body weight (80 kg)

5 ST/IT MOE = ST/IT NOAEL of 1.5 mg/kg bw/day/Daily exposure dose (mg/kg bw/day); target MOE of 100

6 LADD (mg/kg bw/day) = Daily exposure dose (mg/kg bw/day) × Frequency (days/ year=365 days) × Career duration (40 years/lifetime=78 years); Frequency of applications per year: 1 application per year for control of snow mould (12 kg a.i./ha) and 30 days per year for the remaining turf uses

7 Cancer risk = LADD (mg/kg bw/day) × q_1^* of 7.66×10^{-3} (mg/kg bw/day)$^{-1}$; occupational LOC> 1×10^{-5}

Shaded cells indicate risks of concern; EP – end-use product formulation: DF – dry flowable, SN – solution, M/L – mixer/loader; A – applicator

Table 6 Non-cancer and Cancer Exposure and Risk Assessment for Chemical Handlers in Industrial Settings

Scenario	Daily exposure dose[1] (mg/kg bw/day)	ST/IT MOE[2]	LADD[3] (mg/kg bw/day)	Cancer risk[4]
Liquid pour	0.0123[a]	122	8.7×10^{-4}	7×10^{-6}
Liquid pump	0.0067[a]	224	4.8×10^{-4}	4×10^{-6}
Solid pour	0.1141[a]	**13**	8.0×10^{-3}	**6×10^{-5}**
Solid pour	0.0185[b]	**81**	8.0×10^{-3}	1×10^{-5}
Solid place	0.0043[a]	349	3.1×10^{-4}	2×10^{-6}

1 Daily exposure dose (mg/kg bw/day) = Dermal plus inhalation exposure dose accounting for a 19% dermal absorption factor; 90th percentile of the exposure dose for (a) workers wearing a single layer of clothing and gloves (b) workers wearing chemical-resistant coveralls over a single layer clothing and gloves (CMA, 1990) normalized to 80 kg body weight

2 ST/IT MOE = ST/IT NOAEL of 1.5 mg/kg bw/day/Daily exposure dose (mg/kg bw/day); target MOE of 100

3 LADD (mg/kg bw/day) = Daily exposure dose (mg/kg bw/day) × Frequency (50 days/year=365 days) × Career duration (40 years/lifetime=78 years)

4 Cancer Risk = LADD (mg/kg bw/day) × q_1^* of 7.66×10^{-3} (mg/kg bw/day)$^{-1}$; occupational LOC> 1×10^{-5}

Shaded cells indicate risks of concern

Appendix V Occupational Postapplication Exposure and Risk Assessment

Table 1 Non-cancer and Cancer Postapplication Exposure and Risk Assessment for Workers Entering Treated Fields

Crop		Re-entry activity	Application rate[1] (kg a.i./ha)	Maximum number of applications/ RTI[2]	Default DFR[3] (µg a.i./cm^2)	TC[4] (cm^2/hour)	Daily exposure dose[5] (mg/kg bw/day)	MOE[6] (day 0)	Non-cancer REI[7]	TWA DFR or TTR8 (µg a.i./cm^2)	LADD[9] (mg/kg bw/day)	Cancer risk[10]	Cancer REI[11]
Asparagus		Scouting	1.7 (SN)	3 (14 days)	5.44	210	0.0218	69	4	2.78	4.7×10^{-4}	4×10^{-6}	0
		Scouting	1.2 (DF)		3.84	210	0.0154	97	0	1.96	3.3×10^{-4}	3×10^{-6}	0
Blueberry, highbush		Transplanting	3.6	1	9.00	230	0.0394	38	9	2.87	5.3×10^{-4}	4×10^{-6}	0
		Bird control				640	0.0137	109	0		1.8×10^{-4}	1×10^{-6}	0
		Scouting, hand pruning, frost control, hand weeding				640	0.1095	14	19		1.5×10^{-3}	1×10^{-5}	0
		Hand harvesting				1,400	0.2394	6	26		3.2×10^{-3}	2×10^{-5}	5
Blueberry, lowbush		Hand weeding	3.6 (SN)	1	9.00	70	0.0120	125	0	2.87	1.6×10^{-4}	1×10^{-6}	0
		Transplanting				230	0.0394	38	9		5.3×10^{-4}	4×10^{-6}	0
		Hand harvesting, scouting				1,100	0.1881	8	24		2.5×10^{-3}	2×10^{-5}	3
		Irrigation (hand set)				1,750	0.2993	5	28		4.0×10^{-3}	3×10^{-5}	7
		Hand weeding	2.5 (DF)		6.25	70	0.0084	179	0	2.00	1.1×10^{-4}	9×10^{-7}	0
		Transplanting				230	0.0274	55	6		3.7×10^{-4}	3×10^{-6}	0
		Hand harvesting, scouting				1,100	0.1307	11	21		1.8×10^{-3}	1×10^{-5}	0
		Irrigation (hand set)				1,750	0.2079	7	25		2.8×10^{-3}	2×10^{-5}	4
Carrot		Hand weeding	1.6	7 (7 days)	7.62	70	0.0102	147	0	5.43	3.1×10^{-4}	2×10^{-6}	0
		Hand harvesting				1,100	0.1593	9	22		4.8×10^{-3}	4×10^{-5}	9
		Scouting				210	0.0305	49	7		9.1×10^{-4}	7×10^{-6}	0
		Hand weeding	1.2		5.72	70	0.0077	195	0	4.07	2.3×10^{-4}	2×10^{-6}	0
		Harvesting (hand)				1,100	0.1196	13	20		3.6×10^{-3}	3×10^{-5}	6
		Scouting				210	0.0229	66	4		6.9×10^{-4}	5×10^{-6}	0
Celery	Field	Hand weeding	2.0	1	5.00	70	0.0067	224	0	1.60	9.0×10^{-5}	7×10^{-7}	0
		Scouting				210	0.0200	75	3		2.7×10^{-4}	2×10^{-6}	0
		Hand harvesting				1,100	0.1045	14	18		1.4×10^{-3}	1×10^{-5}	0
		Irrigation (hand set)				1,750	0.1663	9	23		2.2×10^{-3}	2×10^{-5}	2
		Hand weeding	0.8		2.00	70	0.0027	556	0	0.64	3.6×10^{-5}	3×10^{-7}	0
		Scouting				210	0.0080	188	0		1.1×10^{-4}	8×10^{-7}	0
		Hand harvesting				1,100	0.0418	36	10		5.6×10^{-4}	4×10^{-6}	0
		Irrigation (hand set)				1,750	0.0665	23	14		9.0×10^{-4}	7×10^{-6}	0
	Seedbed (greenhouse)	All activities	2.0 (DF)		5.00	230	0.0219	68	N/A	5.00	1.5×10^{-3}	1×10^{-5}	N/A
			1.4 (SN)		3.50		0.0153	98	N/A	3.50	1.1×10^{-3}	8×10^{-6}	N/A
			1.0		2.50		0.0110	136	N/A	2.50	7.7×10^{-4}	6×10^{-6}	N/A

Crop		Re-entry activity	Application rate[1] (kg a.i./ha)	Maximum number of applications/ RTI[2]	Default DFR[3] (µg a.i./cm²)	TC[4] (cm²/hour)	Daily exposure dose[5] (mg/kg bw/day)	MOE[6] (day 0)	Non-cancer REI[7]	TWA DFR or TTR8 (µg a.i./cm²)	LADD[9] (mg/kg bw/day)	Cancer risk[10]	Cancer REI[11]
Cherry (sweet and sour) Peach / Nectarine		Orchard maintenance, hand weeding, bird control, propping	4.5	1	11.25	100	0.0214	70	3	3.59	2.9×10^{-4}	2×10^{-6}	0
		Scouting, hand pruning, training				580	0.1240	12	20		1.7×10^{-3}	1×10^{-5}	0
		Hand harvesting				1400	0.2993	5	28		4.0×10^{-3}	3×10^{-5}	7
		Fruit thinning				3000	0.6413	2	36		8.6×10^{-3}	7×10^{-5}	15
		Orchard maintenance, hand weeding, bird control, propping	2.5		6.25	100	0.0119	126	0	2.00	1.6×10^{-4}	1×10^{-6}	0
		Scouting, hand pruning, training				580	0.0689	22	14		9.3×10^{-4}	7×10^{-6}	0
		Hand harvesting				1400	0.1663	9	23		2.2×10^{-3}	2×10^{-5}	2
		Fruit thinning				3000	0.3563	4	30		4.8×10^{-3}	4×10^{-5}	9
Chickpea		Scouting	2.0	1	5.00	1,100	0.1045	14	18	1.60	1.4×10^{-3}	1×10^{-5}	0
		Hand weeding				70	0.0067	224	0		9.0×10^{-5}	7×10^{-7}	0
		Scouting	1.5		3.75	1100	0.0784	19	16	1.20	1.1×10^{-3}	8×10^{-6}	0
		Hand weeding				70	0.0050	300	0		6.8×10^{-5}	5×10^{-7}	0
Cole crops	Broccoli, Brussels sprouts, cauliflower	Scouting	2.4	1	6.00	4,000	0.4560	3	32	1.92	6.2×10^{-3}	5×10^{-5}	11
	Cabbage	Scouting, hand harvesting, mechanically assisted harvesting, thinning plants				1,300	0.1482	10	22		2.0×10^{-3}	2×10^{-5}	1
	Broccoli, Brussels sprouts, cauliflower	Hand harvesting				5,150	0.5871	3	35		7.9×10^{-3}	6×10^{-5}	14
	All Cole crops	Irrigation (hand set)				1,750	0.1995	8	25		2.7×10^{-3}	2×10^{-5}	4
	Broccoli, cabbage, cauliflower, Brussels sprouts	Hand weeding				4,400	0.5016	3	33		6.8×10^{-3}	5×10^{-5}	12
	Broccoli, cauliflower	Thinning plants				1,300	0.1482	10	22		2.0×10^{-3}	2×10^{-5}	1
	Brussels sprouts	Topping				4,000	0.4560	3	32		6.2×10^{-3}	5×10^{-5}	11
	Cauliflower	Tying				4,000	0.4560	3	32		6.2×10^{-3}	5×10^{-5}	11

Crop		Re-entry activity	Application rate[1] (kg a.i./ha)	Maximum number of applications/ RTI[2]	Default DFR[3] (µg a.i./cm^2)	TC[4] (cm^2/hour)	Daily exposure dose[5] (mg/kg bw/day)	MOE[6] (day 0)	Non-cancer REI[7]	TWA DFR or TTR8 (µg a.i./cm^2)	LADD[9] (mg/kg bw/day)	Cancer risk[10]	Cancer REI[11]
	Broccoli, Brussels sprouts, cauliflower	Scouting	1.2	1	3.00	4,000	0.2280	7	26	0.96	3.1×10^{-3}	2×10^{-5}	5
	Cabbage	Scouting, hand harvesting, harvesting mechanically assisted, thinning plants				1,300	0.0741	20	15		1.0×10^{-3}	8×10^{-6}	0
	Broccoli, Brussels sprouts, cauliflower	Hand harvesting				5,150	0.2936	5	28		4.0×10^{-3}	3×10^{-5}	7
	All Cole crops	Irrigation (hand set)				1,750	0.0998	15	18		1.3×10^{-3}	1×10^{-5}	0
	Broccoli, cabbage, cauliflower, Brussels sprouts	Hand weeding				4,400	0.2508	6	27		3.4×10^{-3}	3×10^{-5}	6
	Broccoli, cauliflower	Thinning plants				1,300	0.0741	20	15		1.0×10^{-3}	8×10^{-6}	0
	Brussels sprouts	Topping				4,000	0.2280	7	26		3.1×10^{-3}	2×10^{-5}	5
	Cauliflower	Tying				4,000	0.2280	7	26		3.1×10^{-3}	2×10^{-5}	5
Conifers	Outdoor	Harvest, seed cone	4.8	1	12.00	1,400	0.3192	5	29	3.83	4.3×10^{-3}	3×10^{-5}	8
		Pruning (hand)/scouting				580	0.1323	11	21		1.8×10^{-3}	1×10^{-5}	0
		Irrigation (hand set)				1,750	0.3990	4	31		5.4×10^{-3}	4×10^{-5}	10
		Harvest, seedling production				6,700	1.5276	1	44		2.1×10^{-2}	2×10^{-4}	10
		Harvest, seed cone	1.2		3.00	1,400	0.0798	19	16	0.96	1.1×10^{-3}	8×10^{-6}	0
		Pruning (hand)/scouting				580	0.0331	45	8		4.5×10^{-4}	3×10^{-6}	0
		Irrigation (hand set)				1,750	0.0998	15	18		1.3×10^{-3}	1×10^{-5}	0
		Harvest, seedling production				6,700	0.3819	4	31		5.2×10^{-3}	4×10^{-5}	10
	Nursery beds (greenhouse)	All other activities except for irrigation (hand set)	4.8	1	12.00	230	0.0525	29	N/A	12.00	8.8×10^{-3}	7×10^{-5}	N/A
		Irrigation (hand set)				1,750	0.3990	4	N/A		6.7×10^{-2}	5×10^{-4}	N/A
		All other activities except for irrigation (hand set)	1.2		3.00	230	0.0132	114	N/A	3.00	2.2×10^{-3}	2×10^{-5}	N/A
		Irrigation (hand set)				1,750	0.0998	15	N/A		1.7×10^{-2}	1×10^{-4}	N/A

Crop	Re-entry activity	Application rate[1] (kg a.i./ha)	Maximum number of applications/ RTI[2]	Default DFR[3] (µg a.i./cm^2)	TC[4] (cm^2/hour)	Daily exposure dose[5] (mg/kg bw/day)	MOE[6] (day 0)	Non-cancer REI[7]	TWA DFR or TTR8 (µg a.i./cm^2)	LADD[9] (mg/kg bw/day)	Cancer risk[10]	Cancer REI[11]
Corn, sweet	Scouting	1.6	1	4.00	1,100	0.0836	18	16	1.28	1.1×10^{-3}	9×10^{-6}	0
	Hand harvesting				8,800	0.6688	2	36		9.0×10^{-3}	7×10^{-5}	15
Cranberry	Hand pruning (shears), hand weeding	5.8	1	14.50	70	0.0193	78	2	4.63	2.6×10^{-4}	2×10^{-6}	0
	Transplanting				230	0.0634	24	14		8.5×10^{-4}	7×10^{-6}	0
	Scouting				1,100	0.3031	5	29		4.1×10^{-3}	3×10^{-5}	7
	Hand pruning (shears), hand weeding	3.4		8.50	70	0.0114	132	0	2.71	1.5×10^{-4}	1×10^{-6}	0
	Transplanting				230	0.0372	40	9		5.0×10^{-4}	4×10^{-6}	0
	Scouting				1,100	0.1777	8	23		2.4×10^{-3}	2×10^{-5}	2
Cucurbits	Scouting, hand weeding, hand pruning, thinning fruit	2.4 (DF/SN)	2 (7 days)	8.87	90	0.0152	99	0	3.74	2.7×10^{-4}	2×10^{-6}	0
	Transplanting				230	0.0388	39	9		6.9×10^{-4}	5×10^{-6}	0
	Harvesting (hand, mechanically-assisted)				550	0.0927	16	17		1.6×10^{-3}	1×10^{-5}	0
	Scouting, hand weeding, hand pruning, thinning fruit	1.2 (DF)		4.43	90	0.0076	197	0	1.87	1.4×10^{-4}	1×10^{-6}	0
	Transplanting				230	0.0194	77	2		3.5×10^{-4}	3×10^{-6}	0
	Harvesting (hand, mechanically-assisted)				550	0.0463	32	11		8.2×10^{-4}	6×10^{-6}	0
	Scouting, hand weeding, hand pruning, thinning fruit	0.4 (SN)		1.48	90	0.0026	577	0	0.62	4.5×10^{-5}	3×10^{-7}	0
	Transplanting				230	0.0065	231	0		1.2×10^{-4}	9×10^{-7}	0
	Harvesting (hand, mechanically-assisted)				550	0.0155	97	0		2.7×10^{-4}	2×10^{-6}	0
Evening primrose	Scouting	1.2	1	3.00	1,100	0.0627	24	14	0.96	8.5×10^{-4}	6×10^{-6}	0
Ginseng	Hand weeding	2.4	1	6.00	70	0.0080	188	0	1.92	1.1×10^{-4}	8×10^{-7}	0
	Scouting				210	0.0240	63	4		3.2×10^{-4}	2×10^{-6}	0
	Hand harvesting				1,100	0.1254	12	20		1.7×10^{-3}	1×10^{-5}	0
	Hand weeding	1.2		3.00	70	0.0040	375	0	0.96	5.4×10^{-5}	4×10^{-7}	0
	Scouting				210	0.0120	125	0		1.6×10^{-4}	1×10^{-6}	0

Crop		Re-entry activity	Application rate[1] (kg a.i./ha)	Maximum number of applications/ RTI[2]	Default DFR[3] (µg a.i./cm²)	TC[4] (cm²/hour)	Daily exposure dose[5] (mg/kg bw/day)	MOE[6] (day 0)	Non-cancer REI[7]	TWA DFR or TTR8 (µg a.i./cm²)	LADD[9] (mg/kg bw/day)	Cancer risk[10]	Cancer REI[11]
		Hand harvesting				1,100	0.0627	24	14		8.5×10^{-4}	6×10^{-6}	0
Lentil		Scouting	2.0	1	5.00	1,100	0.1045	14	18	1.55	1.4×10^{-3}	1×10^{-5}	0
		Scouting	1.0		2.5	1100	0.0523	29	12	0.78	6.9×10^{-4}	5×10^{-6}	0
Mushroom (mushroom house)		Cutting, harvesting, sorting, packing	12.7	1	0.31	2,500	0.0148	101	N/A	0.31	1.0×10^{-3}	8×10^{-6}	N/A
Onion	Dry bulb	Scouting	2.4	1	6.00	1,300	0.1482	10	22	1.92	2.0×10^{-3}	2×10^{-5}	1
		Hand weeding				4,400	0.5016	3	33		6.8×10^{-3}	5×10^{-5}	12
		Scouting	1.2		3.00	1,300	0.0741	20	15	0.96	1.0×10^{-3}	8×10^{-6}	0
		Hand weeding				4,400	0.2508	6	27		3.4×10^{-3}	3×10^{-5}	6
	Green	Scouting, hand harvesting (green)	2.4		6.00	1,300	0.1482	10	22	1.92	2.0×10^{-3}	2×10^{-5}	1
		Hand weeding				4,400	0.5016	3	33		6.8×10^{-3}	5×10^{-5}	12
		Scouting, hand harvesting (green)	1.2		3.00	1,300	0.0741	20	15	0.96	1.0×10^{-3}	8×10^{-6}	0
		Hand weeding				4,400	0.2508	6	27		3.4×10^{-3}	3×10^{-5}	6
Ornamentals greenhouse	Cut flowers - roses	Hand harvesting	1.9	1	4.75	4,000	0.1354	11	N/A	4.75	4.9×10^{-2}	4×10^{-4}	N/A
	Cut flowers - roses	Disbudding, hand pruning				4,000	0.3610	4	N/A		1.3×10^{-1}	1×10^{-3}	N/A
	Roses	Irrigation (hand set)				1,750	0.1580	9	N/A		5.8×10^{-2}	4×10^{-4}	N/A
	Roses	All other activities except for irrigation (hand set)				230	0.0208	72	N/A		7.6×10^{-3}	6×10^{-5}	N/A
	Cut flowers - other than roses	Hand harvesting	2.5		6.25	4,000	0.2969	5	N/A	6.25	4.2×10^{-2}	3×10^{-4}	N/A
	Cut flowers - other than roses	Disbudding, hand pruning				4,000	0.4750	3	N/A		6.7×10^{-2}	5×10^{-4}	N/A
	Ornamentals other than roses and pachysandra	Irrigation (hand set)				1,750	0.2079	7	N/A		7.6×10^{-2}	6×10^{-4}	N/A
		All other activities except for irrigation (hand set)				230	0.0274	55	N/A		1.0×10^{-2}	8×10^{-5}	N/A
	Pachysandra	Irrigation (hand set)	5.0		12.50	1,750	0.4157	4	N/A	12.50	1.5×10^{-1}	1×10^{-3}	N/A
		All other activities except for irrigation (hand set)				230	0.0547	27	N/A		2.0×10^{-2}	2×10^{-4}	N/A
Ornamentals outdoor		All activities except irrigation (hand set)	2.5	1	6.25	230	0.0274	55	6	1.24	3.8×10^{-4}	3×10^{-6}	0
		Irrigation (hand set)				1,750	0.2079	7	25		2.9×10^{-3}	2×10^{-5}	4
Parsnip		Hand weeding, thinning	1.4	7 (7 days)	6.67	70	0.0089	169	0	4.75	2.7×10^{-4}	2×10^{-6}	0
		Hand harvesting				1,100	0.1395	11	21		4.2×10^{-3}	3×10^{-5}	8

Crop		Re-entry activity	Application rate[1] (kg a.i./ha)	Maximum number of applications/ RTI[2]	Default DFR[3] (µg a.i./cm²)	TC[4] (cm²/hour)	Daily exposure dose[5] (mg/kg bw/day)	MOE[6] (day 0)	Non-cancer REI[7]	TWA DFR or TTR8 (µg a.i./cm²)	LADD[9] (mg/kg bw/day)	Cancer risk[10]	Cancer REI[11]
		Scouting				210	0.0267	56	5		8.0×10^{-4}	6×10^{-6}	0
Pea, dry		Scouting	1.5	1	3.75	1,100	0.0784	19	16	1.20	1.1×10^{-3}	8×10^{-6}	0
		Scouting	1.0		2.50	1,100	0.0523	29	12	0.80	7.1×10^{-4}	5×10^{-6}	0
Potato		Scouting	1.2	1	5.75	210	0.0120	125	0	0.96	1.6×10^{-4}	1×10^{-6}	0
		Hand weeding				70	0.0040	375	0		5.4×10^{-5}	4×10^{-7}	0
		Roguing				1000	0.0570	26	13		7.7×10^{-4}	6×10^{-6}	0
Strawberry		Hand weeding, canopy management	1.8	2 (10 days)	6.07	70	0.0081	185	0	2.75	1.6×10^{-4}	1×10^{-6}	0
		Scouting				210	0.0243	62	5		4.6×10^{-4}	4×10^{-6}	0
		Transplanting				230	0.0266	56	5		5.1×10^{-4}	4×10^{-6}	0
		Hand harvesting				1,100	0.1269	12	20		2.4×10^{-3}	2×10^{-5}	3
Tomato		Hand pruning, hand weeding	2.4	1	6.00	70	0.0080	188	0	1.92	1.1×10^{-4}	8×10^{-7}	0
		Scouting				210	0.0240	63	4		3.2×10^{-4}	2×10^{-6}	0
		Hand harvesting				1,100	0.1254	12	20		1.7×10^{-3}	1×10^{-5}	0
		Hand pruning, hand weeding	1.2		3.00	70	0.0040	375	0	0.96	5.4×10^{-5}	4×10^{-7}	0
		Scouting				210	0.0120	125	0		1.6×10^{-4}	1×10^{-6}	0
		Hand harvesting				1,100	0.0627	24	14		8.5×10^{-4}	6×10^{-6}	0
Wheat		Hand weeding	1.3	1	3.25	70	0.0044	341	0	1.04	5.9×10^{-5}	5×10^{-7}	0
		Scouting			3.25	1,100	0.0680	22	14		9.2×10^{-4}	7×10^{-6}	0
		Hand weeding	0.7		1.75	70	0.0024	625	0	0.56	3.2×10^{-5}	2×10^{-7}	0
		Scouting			1.75	1,100	0.0366	41	8		4.9×10^{-4}	4×10^{-6}	0
Turf	Golf course (greens, tees)	Maintenance	12.0	1	1.2	2,500	0.0570	26	13	0.38	5.1×10^{-4}	4×10^{-6}	0
	Golf course (greens, tees, and fairways), Sod farm	Transplanting/ planting (and slab harvesting for sod farm workers)				6,700	0.1528	10	22		1.4×10^{-3}	1×10^{-5}	0
		Mowing, watering, cup changing, irrigation repair, miscellaneous grooming				3,500	0.0798	19	16		5.0×10^{-4}	4×10^{-6}	0
		Aerating, fertilizing, hand pruning, mechanical weeding, scouting and seeding				1,000	0.0228	66	4		1.4×10^{-4}	1×10^{-6}	0
	Golf course (greens, tees)	Maintenance	9.5	1	0.95	2,500	0.0452	33	10	0.30	4.0×10^{-4}	3×10^{-6}	0

Crop		Re-entry activity	Application rate[1] (kg a.i./ha)	Maximum number of applications/ RTI[2]	Default DFR[3] (µg a.i./cm^2)	TC[4] (cm^2/hour)	Daily exposure dose[5] (mg/kg bw/day)	MOE[6] (day 0)	Non-cancer REI[7]	TWA DFR or TTR8 (µg a.i./cm^2)	LADD[9] (mg/kg bw/day)	Cancer risk[10]	Cancer REI[11]
	Golf course (greens, tees, and fairways), Sod farm	Transplanting/ planting (and slab harvesting for sod farm workers)				6,700	0.1210	12	20		1.1×10^{-3}	8×10^{-6}	0
		Mowing, watering, cup changing, irrigation repair, miscellaneous grooming				3,500	0.0632	24	14		3.9×10^{-4}	3×10^{-6}	0
		Aerating, fertilizing, hand pruning, mechanical weeding, scouting and seeding				1,000	0.0181	83	2		1.1×10^{-4}	9×10^{-7}	0
	Golf course (greens, tees)	Maintenance				2,500	0.0228	66	4		2.0×10^{-4}	2×10^{-6}	0
	Golf course (greens, tees, and fairways), Sod farm	Transplanting/ planting (slab harvesting for sod farm workers)	4.8	1	0.48	6,700	0.0612	25	13	0.15	5.4×10^{-4}	4×10^{-6}	0
		Mowing, watering, cup changing, irrigation repair, miscellaneous grooming				3,500	0.0320	47	7		2.0×10^{-4}	2×10^{-6}	0
		Aerating, fertilizing, hand pruning, mechanical weeding, scouting and seeding				1,000	0.0092	163	0		5.7×10^{-5}	4×10^{-7}	0

1 Application rate (kg a.i./ha) according to current product labels

2 Maximum number of application/RTI – a number of applications resulting in Re-entry Intervals (REIs) that may be agronomically feasible; RTI - re-treatment interval according to current product labels; For strawberry, two applications at a RTI of 10 days assumed for risk assessment as the 3rd application is done in the fall

3 DFR/TTR – Dislodgeable Foliar Residue/Turf Transferable Residue (µg a.i./cm2) calculated for agricultural uses assuming a default 25% residue deposition with 10% (outdoor uses) or 0% (greenhouse uses) residue dissipation per day; for turf uses assuming a default 1% residue deposition with 10% residue dissipation per day

4 TC – Transfer Coefficient (cm^2/hour), Agricultural Re-entry Task Force (ARTF) database or United States Environmental Protection Agency (USEPA) Policy#003

5 Daily exposure dose (mg/kg bw/day) = DFR/TTR (µg a.i./cm^2) × TC (cm^2/hour) × Exposure duration (hours) × DA (19%)/ Average worker body weight (80 kg) × conversion factor (1 mg/1000 µg); Exposure duration of 8 hours per day except the following post application activities: bird control (blueberry, highbush) – 1 hour; hand harvesting of cut flowers – 3 hours (roses) or 5 hours (other than roses)

6 MOE = NOAEL of 1.5 mg/kg bw/day/Daily exposure dose (mg/kg bw/day); target MOE of 100

7 Non-cancer REI – a minimum REI required to mitigate a non-cancer risk to postapplication workers

[8] TWA (Time-Weighted Average) DFR/TTR calculated over 30 days.

[9] LADD (mg/kg bw/day) = [TWA DFR (µg a.i./cm^2) × TC (cm^2/hour) × exposure duration (hours) × DA (19%)/ average worker body weight (80 kg) × conversion factor (1 mg/1000 µg)] × Frequency (days/year=365 days) × Career duration (40 years/ lifetime=78 years); Frequency - 30 days (default) except for: celery seedbeds, mushrooms, outdoor ornamentals – 50 days; conifers (nursery beds) – 120 days; greenhouse ornamentals 260 days (cut flowers – roses; other ornamentals) or 100 days (cut flowers other than roses); turf 20 days (maintenance, transplanting/planting) or 14 days (other activities)

[10] Cancer risk = LADD (mg/kg bw/day) × q_1* of 7.66 × 10^{-3} (mg/kg bw/day)$^{-1}$; occupational LOC> 1 × 10^{-5}

[11] Cancer REI – a minimum REI required to mitigate a cancer risk to postapplication workers

Shaded cells indicate risks of concern; solution (SN) or dry flowable (DF) formulation

Table 2 Non-cancer and Cancer Risk Assessment for Professional Painters

Scenario	Application rate[1] (kg a.i./L)	Volume handled per day[2] (L)	Combined UE[3] (mg/kg a.i.)	Daily exposure dose[4] (mg/kg bw/day)	MOE[5]	LADD[6] (mg kg bw/day)	Cancer risk[7]
brush/roller	0.002	19	76.67	0.0365	**41**	5.1×10^{-4}	$\mathbf{4 \times 10^{-5}}$
brush/roller	0.005	19	76.67	0.0911	**16**	1.3×10^{-2}	$\mathbf{1 \times 10^{-4}}$
brush/roller	0.012	19	76.67	0.2131	**7**	3.0×10^{-2}	$\mathbf{2 \times 10^{-4}}$
airless sprayer	0.002	190	17.17	0.0816	**18**	1.1×10^{-2}	$\mathbf{9 \times 10^{-5}}$
airless sprayer	0.005	190	17.17	0.2039	**7**	2.9×10^{-2}	$\mathbf{2 \times 10^{-4}}$
airless sprayer	0.012	190	17.17	0.4771	**3**	6.7×10^{-2}	$\mathbf{5 \times 10^{-4}}$

[1] Application rate (kg a.i./ha) according to current product labels

[2] Volume handled per day (L) –based on previous PMRA assessments for similar antimicrobial active ingredients

[3] Combined UE (mg/kg a.i.) - Combined Unit Exposure (UE) = Dermal plus inhalation UE (PHED)

[4] Daily exposure dose (mg/kg bw/day) = Application rate (kg a.i./ha) × Volume (L) × Combined UE (mg/kg a.i.) / Average worker body weight (80 kg)

[5] ST/IT/LT MOE = ST/IT/LT NOAEL of 1.5 mg/kg bw/day/Daily exposure dose (mg/kg bw/day); target MOE of 100

[6] LADD (mg/kg bw/day) = Daily exposure dose (mg/kg bw/day) × Frequency (250 days/year=365 days) × Career duration (16 years/lifetime=78 years)

[7] Cancer risk = LADD (mg/kg bw/day) × q_1^* of 7.66×10^{-3} (mg/kg bw/day)$^{-1}$; occupational LOC> 1×10^{-5}

Shaded cells indicate risks of concern

Appendix VI Non-occupational Exposure and Risk Assessment

Table 1 Non-cancer and Cancer Exposure and Risk Assessment for Homeowners Applying Treated Paint

Scenario	Application rate[1] (kg a.i./L)	Combined UE[2] (mg/kg a.i.)	Volume handled per day[3] (L)	Daily exposure dose[4] (mg/kg bw/day)	MOE[5]	LADD[6] (mg kg bw/day)	Cancer risk[7]
brush/roller	0.002	98.28	7.6	0.0187	**80**	1.4×10^{-4}	1×10^{-6}
brush/roller	0.005			0.0467	**32**	3.3×10^{-4}	**3×10^{-6}**
brush/roller	0.012			0.1093	**14**	7.7×10^{-4}	**6×10^{-6}**
airless sprayer	0.002	35.68	58	0.0517	**29**	3.7×10^{-4}	**3×10^{-6}**
airless sprayer	0.005			0.1294	**12**	9.1×10^{-4}	**7×10^{-6}**
airless sprayer	0.012			0.3027	**5**	2.1×10^{-3}	**2×10^{-5}**

1 Application rate (kg a.i./L) according to the current product labels
2 Combined UE (mg/kg a.i.) – Combined Unit Exposure (UE) = Dermal plus inhalation UE (PHED) accounting for 19% dermal absorption
3 Volume handled per day (USEPA, 2012)
4 Daily exposure dose (mg/kg bw/day) = Application rate (mg a.i./L) × Combined UE (mg/kg a.i.) × Volume handled per day (L/day) / Average adult body weight (80 kg)
5 MOE = NOAEL of 1.5 mg/kg bw/day/Daily exposure dose (mg/kg bw/day); target MOE of 100
6 LADD (mg/kg bw/day) = Daily exposure dose (mg/kg bw/day) × Frequency (4 days/ year=365 days) × Exposure duration (50 years/lifetime=78 years)
7 Cancer risk = LADD (mg/kg bw/day) × q1* of 7.66×10^{-3} $(mg/kg\ bw/day)^{-1}$; residential LOC > 1×10^{-6}
Shaded cells indicated risks of concern

Table 2 Acute Aggregate Eexposure and Risk Assessment for Individuals at PYO Facilities

Crop	Population subgroup	DFR[1] (µg/cm^2)	TC[2] (cm^2/hour)	Average body weight (kg)	Acute dermal exposure dose[3] (mg/kg bw/day)	Acute dermal MOE[4]	Acute dietary exposure dose[5] (mg/kg bw/day)	Acute dietary[6] MOE	ARI[7]
Strawberry	Adults (16 to <80 years)	0.19	1100	80	0.00100	600 000	0.00014	>1 000 000	2143
	Youth (11 to <16 years)	0.19	897	57	0.00114	526 316	0.00016	>1 000 000	2041
	Children (3 to <6 years)	0.19	429	19	0.00164	365 854	0.00057	308 634	803
Blueberry	Adult (16 to <80 years)	0.03	1100	80	0.00016	3 750 000	0.00029	608 678	1925
	Youth (11 to <16 years)	0.03	897	57	0.00018	3 333 333	0.00025	713 408	2220
	Children (3 to <6 years)	0.03	429	19	0.00026	2 307 692	0.00056	312 065	995
Cherry	Adult (16 to <80 years)	0.17	1400	80	0.00114	526 316	0.00013	>1 000 000	2041
	Youth (11 to <16 years)	0.17	1142	57	0.00130	461 538	0.00009	>1 000 000	1935
	Children (3 to <6 years)	0.17	546	19	0.00186	322 581	0.00018	976 674	1620
Nectarine	Adult (16 to <80 years)	0.02	1400	80	0.00014	4 285 714	0.00218	80 382	266
	Youth (11 to <16 years)	0.02	1142	57	0.00016	3 750 000	0.00142	123 051	406
	Children (3 to <6 years)	0.02	546	19	0.00022	2 727 273	0.00553	31 630	105
Peach	Adult (16 to <80 years)	0.02	1400	80	0.00014	4 285 714	0.00089	195 650	642
	Youth (11 to <16 years)	0.02	1142	57	0.00016	3 750 000	0.00093	188 480	618
	Children (3 to <6 years)	0.02	546	19	0.00022	2 727 273	0.00363	48 158	160

1 DFR - Dislodgeable Foliar Residue (µg/cm^2), default value estimated at the existing pre-harvest interval (PHI) of 30 days for strawberry, 54 days for blueberry, 40 days for cherry, and 60 days for nectarine and peach

2 TC - Transfer Coefficient (cm^2/hour), TCs for children and youth were adjusted based on the average skin surface area for a child (0.76 m^2) and youth (1.59 m^2), as compared to the average skin surface area for adults (1.95 m^2), and the standard TC for adult workers hand-harvesting berries (1100 cm^2/hr) or orchard fruits (1400 cm^2/hr)

3 Acute dermal exposure dose (mg/kg bw/day) = DFR (µg/cm^2) × TC (cm^2/hour) × Exposure duration (2 hours for all population subgroups)/ Average body weight (kg)

4 Acute dermal MOE = dermal NOAEL of 600 mg/kg bw/day/Dermal Daily exposure Dose (mg/kg bw/day); target acute dermal MOE of 100

[5] Acute dietary exposure dose (mg/kg bw/day) from the 95th percentile on a "per user" basis of acute exposure to chlorothalonil from strawberry at the MRL of 0.1 ppm, blueberry at the MRL of 1.0 ppm, cherry at the MRL of 0.5 ppm for cherry, nectarine at the MRL of 0.5 ppm, and peach at the MRL of 0.5 ppm, using DEEM-FCID™ (V.3.14)

[6] Acute dietary MOE = LOAEL of 175 mg/kg bw/day/Acute dietary exposure (mg/kg bw/day); target acute dietary MOE of 300

[7] ARI - Aggregate Risk Index = 1/[(dermal UF/Acute Dermal MOE) + (dietary UF/Acute Dietary MOE)]. If calculated ARI exceeds 1, the risk is below the level of concern; Uncertainty Factor (UF) of 100 and 300 for dermal and oral routes of exposure

Table 3 Non-cancer and Cancer Exposure and Risk Assessment for Golfers

Scenario	TTR[1] (µg a.i./cm^2)	TC[2] (cm^2/hr)	Exposure duration (hours/day)	Average body weight (kg)	Daily exposure dose[3] (mg/kg bw/day)	MOE[4]	Frequency (days/year)	Exposure duration (years)	LADD[5] (mg/kg bw/day)	Cancer risk[6]
Adult golfer	0.48	5300	4	80	0.02417	**62**	14	63	7.5×10^{-4}	**6×10^{-6}**
Youth golfer (11to <16 years)		4400	4	57	0.02816	**53**	14	5	6.9×10^{-5}	5×10^{-7}
Child golfer (6 to <11 years)		2900	4	32	0.03306	**45**	14	5	8.1×10^{-5}	6×10^{-7}
Adult golfer	0.95	5300	4	80	0.04784	**31**	14	63	1.5×10^{-3}	**1×10^{-5}**
Youth golfer (11to <16 years)		4400	4	57	0.05574	**27**	14	5	1.4×10^{-4}	1×10^{-6}
Child golfer (6 to <11 years)		2900	4	32	0.06544	**23**	14	5	1.7×10^{-4}	1×10^{-6}

[1] TTR – Turf Transferable Residue (µg/cm^2) estimated assuming 1% residue deposition with 10% residue dissipation per day following a single application at the rate of 4.8 or 9.54 kg a.i./ha

[2] TC – Transfer Coefficient (cm^2/hour), TCs for children and youth were adjusted based on the average skin surface area for a child 6 to<11 years (1.08 m^2) and youth (1.59 m^2), as compared to the average skin surface area for adults (1.95 m^2) and a standard TC for adults (USEPA, 2012))

[3] Daily exposure dose (mg/kg bw/day) = TTR (mg/cm^2) × TC (cm^2/hour) × Exposure duration (hours/day) × 19% dermal absorption/ Average body weight (kg)

[4] MOE = NOAEL of 1.5 mg/kg bw/day /Daily exposure dose (mg/kg bw/day); target MOE of 100

[5] LADD (mg/kg bw/day) = Daily Exposure Dose (mg/kg bw/day) × Frequency (days/ year=365 days) × Exposure duration (years/lifetime=78 years)

[6] Cancer risk = LADD (mg/kg bw/day) × q1* of 7.66×10^{-3} (mg/kg bw/day)$^{-1}$, residential LOC > 1×10^{-6}

Shaded cells indicated risks of concern

Table 4 Non-cancer and Cancer Inhalation Exposure and Risk Assessment for a Bystander

Population	Air concentration[1] (mg/m^3)	Inhalation rate[2] (m^3/hour)	Average body weight[2] (kg)	Outdoor exposure time[3] (hours/day)	Daily exposure dose (mg/kg bw/day)[4]	MOE[5]	Frequency (days/year)	Exposure duration (years)	LADD[6] (mg/kg bw/day)	Cancer risk[7]	Lifetime cancer risk[8]
Child (1 to<2 years)	0.0232	0.33	11	6	0.004176	359	12	5	8.9×10^{-6}	7×10^{-8}	4×10^{-7}
Child (6 to <11 years)		0.5	32		0.002175	690		5	4.6×10^{-6}	4×10^{-8}	
Youth (11to <16 years)		0.63	57		0.001539	975		5	3.3×10^{-6}	3×10^{-8}	
Adult (16 to <80 years)		0.64	80		0.001114	1346		63	3.0×10^{-5}	2×10^{-7}	
Child (1 to<2 years)	0.000636	0.33	11	0.6	0.000012	125 000	180	5	4.0×10^{-7}	3×10^{-9}	9×10^{-8}
Child (6 to <11 years)		0.5	32	2.2	0.000022	68 182		5	7.0×10^{-7}	5×10^{-9}	
Youth (11to <16 years)		0.63	57	1.7	0.000012	125 000		5	4.0×10^{-7}	3×10^{-9}	
Adult (16 to <80 years)		0.64	80	4.7	0.000024	62 500		63	9.6×10^{-6}	7×10^{-8}	

1 Air concentration (mg/m^3) - spray drift (Garron et al, 2012) and ambient air (White et al. 2006)

2 Inhalation rate (m^3/hour) and body weight (kg) (USEPA, 2012)

3 Outdoor exposure time (hours/day) –6 hours (Garron et al., 2012) and subpopulation-specific (2011 USEPA Exposure Factors Handbook)

4 Daily exposure dose (mg/kg bw/day) = Air concentration (mg/cm^3) × Inhalation rate (m^3/hour) × Outdoor exposure time (hours/day)/ Average body weight (kg)

5 MOE = NOAEL of 1.5 mg/kg bw/day /Daily exposure dose (mg/kg bw/day); target MOE of 100

6 LADD (mg/kg bw/day) = Daily exposure dose (mg/kg bw/day) × Frequency (days/ year=365 days) × Exposure duration (years/lifetime=78 years)

7 Cancer risk = LADD (mg/kg bw/day) × q1* 7.66×10^{-3} $(mg/kg\ bw/day)^{-1}$; residential LOC > 1×10^{-6}

8 Lifetime cancer risk - combined cancer risks for children, youth and adults; residential LOC > 1×10^{-6}

Appendix VII Proposed Label Amendments for Products Containing Chlorothalonil

The revised label amendments presented below pertains to the protection of human health and do not include all label requirements for individual end use products, such as first aid statements, disposal statements, precautionary statements, supplementary protective equipment, and environmental label statements. Additional information on labels of currently registered products should not be removed unless it contradicts the label statements given below.

The labels of end-use products in Canada must be amended to include the following statements to further protect workers and individuals in residential settings.

I. The following uses must be removed from the appropriate end-use product labels:

Blueberry, highbush
Blueberry, lowbush
Celery, field
Cherry, sweet and sour
Chickpea
Cole crops
Conifers (outdoor and nursery beds)
Corn, sweet
Cranberry
Evening primrose
Lentil
Onion, dry and green
Ornamentals, greenhouse and outdoor
Nectarine
Pea, dry
Peach
Turf (except for control of snow moulds)
Wheat
Paint

II. The following application methods must be removed from the appropriate end-use product labels:

Tomato – aerial application
Cucurbits – sprinkler irrigation
Strawberry – sprinkler irrigation

III. The appropriate agriculture end-use product labels must be amended to include the following statement for the tomato use:

DO NOT apply by air.

PRECAUTIONS Section

Personal Protective Equipment/Engineering Controls

For consistency between product labels, and for the purpose mitigating the risk of exposure to chlorothalonil, the following directions must be included on end-use product labels as listed in Table 1:

Table 1 Required Personal Protective Equipment and Engineering Controls for Mixer/Loaders and Applicators.

Crop	Application method	End-use products formulated as a suspension/emulsifiable concentrate	End-use product formulated as dry flowable/Water dispersible granules
Asparagus Carrot Cucurbits Ginseng Parsnip Strawberry Tomato	Groundboom	*Wear goggles or face shield during mixing, loading, clean-up, maintenance, and repair. Wear coveralls over a long-sleeved shirt, long pants, chemical-resistant gloves, socks and chemical resistant footwear during mixing/loading, application, clean-up, maintenance, and repair. In addition, mixers/loaders must wear a respirator with a NIOSH-approved organic vapour-removing cartridge with a prefilter approved for pesticides OR a NIOSH-approved canister approved for pesticides*	*Wear goggles or face shield during mixing, loading, clean-up, maintenance, and repair. Wear coveralls over a long-sleeved shirt, long pants, chemical-resistant gloves, socks and chemical resistant footwear during mixing/loading, application, clean-up, maintenance, and repair. In addition, mixers/loaders must wear a respirator with a NIOSH-approved organic vapour-removing cartridge with a prefilter approved for pesticides OR a NIOSH-approved canister approved for pesticides* *Mixers/loaders must use a closed mixing and loading system if they will be handling more than 50 kg a.i./day which corresponds to:* *-55 kg of Echo 90 DF Agriculture Fungicide (Reg. No. 29356) or* *-60 kg of Bravo Ultrex (Reg. No. 29306).*

Crop	Application method	End-use products formulated as a suspension/emulsifiable concentrate	End-use product formulated as dry flowable/Water dispersible granules
Mushroom Celery, seedbeds	Manually-pressurized handgun Backpack sprayer Chemigation	*Wear goggles or face shield during mixing, loading, clean-up, maintenance, and repair. Wear coveralls over a long-sleeved shirt, long pants, chemical-resistant gloves, socks and chemical resistant footwear during mixing/loading, application, clean-up, maintenance, and repair. In addition, mixers/loaders and applicators using handheld equipment must wear a respirator with a NIOSH-approved organic vapour-removing cartridge with a prefilter approved for pesticides OR a NIOSH-approved canister approved for pesticides.*	
Potato	Groundboom	*Mixers and loaders must use a closed mixing and loading system. Wear coveralls over a long-sleeved shirt, long pants, chemical-resistant gloves, socks and chemical resistant footwear during mixing/loading, application, clean-up, maintenance, and repair. Applicators must use groundboom equipment with an enclosed cab. Gloves are not required for an applicator in an enclosed cab. A closed cab is a chemical resistant barrier that completely surrounds the occupant of the cab and prevents contact with the pesticide or treated surfaces outside the cab.*	
	Aerial	*Mixers and loaders must use a closed mixing and loading system. Wear goggles or face shield during mixing, loading, clean-up, maintenance, and repair. The field crew and the mixers/loaders must wear coveralls over a long sleeved shirt and long pants, chemical resistant gloves, socks and chemical resistant footwear. Aerial applicators are not required to wear chemical-resistant gloves. Do not allow the pilot to mix chemicals to be loaded onto the aircraft.*	
Turf (snow mould control only)	Groundboom Manually-pressurized turfgun Backpack sprayer	*<u>Groundboom application:</u> Mixers and loaders for groundboom equipment must use a closed mixing and loading system. Wear goggles or face shield during mixing, loading, clean-up, maintenance and repair. Wear coveralls over a long-sleeved shirt, long pants, chemical-resistant gloves, socks and chemical resistant footwear during mixing/loading, application, clean-up, maintenance and repair. Applicators must use groundboom equipment with an enclosed cab. Gloves are not required for an applicator in an enclosed cab. A closed cab is a chemical resistant barrier that completely surrounds the occupant of the cab and prevents contact with the pesticide or treated surfaces outside the cab.* *<u>Handheld equipment application:</u> Wear goggles or face shield during mixing, loading, clean-up, maintenance and repair. Wear coveralls over a long-sleeved shirt, long pants, chemical-resistant gloves, socks and chemical resistant footwear during mixing/loading, application, clean-up, maintenance and repair. In addition, mixers/loaders for handheld equipment must wear a respirator with a NIOSH-*	

Crop	Application method	End-use products formulated as a suspension/emulsifiable concentrate	End-use product formulated as dry flowable/Water dispersible granules
		approved organic vapour-removing cartridge with a prefilter approved for pesticides OR a NIOSH-approved canister approved for pesticides. *Mixer/loader/applicators using a backpack sprayer, must not handle more than 2.0 kg a.i./day which corresponds to 0.17 ha (1700 m^2) treated at a rate of 12 kg a.i./ha.*	

All end-use product labels, except for end-use products Registration No. 29355 and 30333, must include the requirement of goggles or face shield.

Restricted-Entry Intervals

The appropriate end-use product labels must include the following statement:

> ***DO NOT** enter or allow worker re-entry into treated areas during the restricted entry intervals of (value from Table 2) days for (activity from Table 2), (value from Table 2) days for (activity from Table 2), and a minimum of 12 hours (unless a specific REI value is already identified on the current product label) for all other activities.*

Table 2 Required REIs for Crops Treated with Chlorothalonil

Crop	Activity	REI (days)
Asparagus	Scouting	4
Carrots	Hand harvesting	22
	Scouting	7
Cucurbits	Transplanting	9
	Harvesting, hand, mechanically-assisted	17
Ginseng	Scouting	4
	Hand harvesting	20
Parsnip	Hand harvesting	21
	Scouting	5
Potato	Rouging	13
Strawberry	Scouting	5
	Transplanting	5
	Hand harvesting	20
Tomato	Scouting	4
	Hand harvesting	20

Turf (for control of snow mould only)

DO NOT enter or allow worker re-entry into treated area following the late fall application for control of snow mould during the restricted re-entry interval of 22 days.

Golf course superintendents must ensure that the general public is not allowed to enter into treated golf courses following the late fall application for control of snow mould.

Mushrooms and celery seed beds (greenhouse)

***DO NOT** enter or allow worker re-entry into treated areas during the restricted entry intervals of 48 hours.*

DIRECTIONS FOR USE Section

Application rate

The appropriate labels of end-use products formulated as dry flowables or water dispersible granules must be changed to specify a reduced maximum application rate for celery, seedbeds of 1.4 kg a.i./ha.

Number of applications

The appropriate agriculture end-use product labels must be amended to specify:

DO NOT make more than (value from Table 3) application(s) per season with a minimum of (value from Table 3) days between applications regardless of the disease being treated.

Table 3 Number of Applications and Re-treatment Intervals.

Crop	Applications per year	
	Number	Interval (days)
Asparagus	3	14
Carrot	7	7
Celery, seedbeds	1	-
Cucurbits	2	7
Ginseng	1	-
Mushroom	1	-
Parsnip	7	7
Potato	1	-
Strawberry	3	10
Tomato	1	-

Turf (snow mould control)	1	-

Additional label statement to be included on all end-use product labels:
DO NOT apply this product in such a manner as to directly, or through drift, expose workers or other persons. Unprotected persons must be vacated from the area being treated. Only protected handlers may be in the area during application.

Additional Label Amendments:

Turf use
The following statement must be included on the primary panel of the end-use product registered for the turf use:

For control of snow mould on golf course and sod farm turf.

Greenhouse uses:
Appropriate end-use product labels must include the following statement:

1) For end-use products registered for agricultural uses including the use on celery seedbeds:

   Do NOT use on greenhouse-grown agriculture crops with the exception of celery seedbeds.

2) For end-use product registered for agricultural uses excluding the use on celery seedbeds:

   DO NOT use on greenhouse-grown agriculture crops.

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Studies/Information Submitted by the Registrant(s)

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